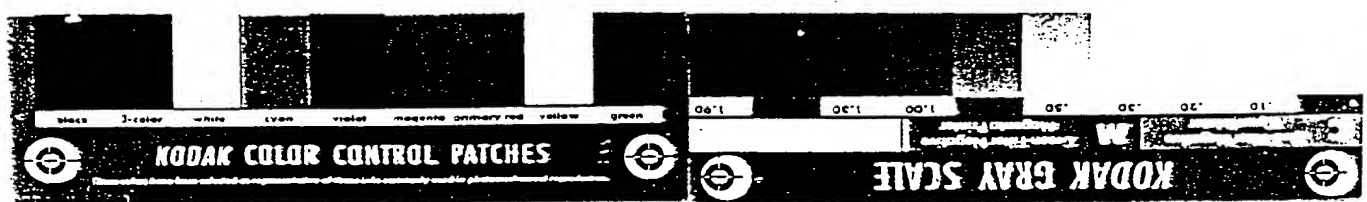


Fig. 1

Color comparison of various passive layers

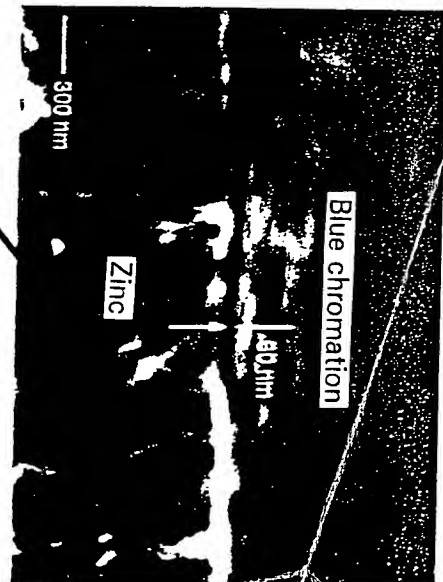
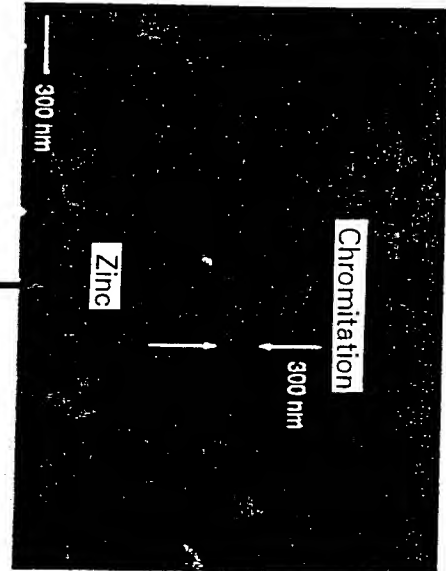
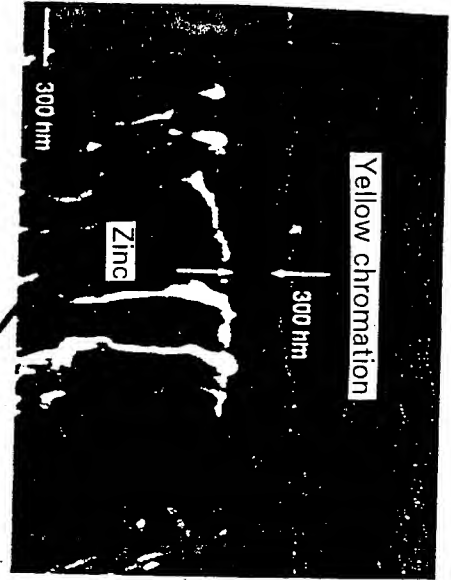
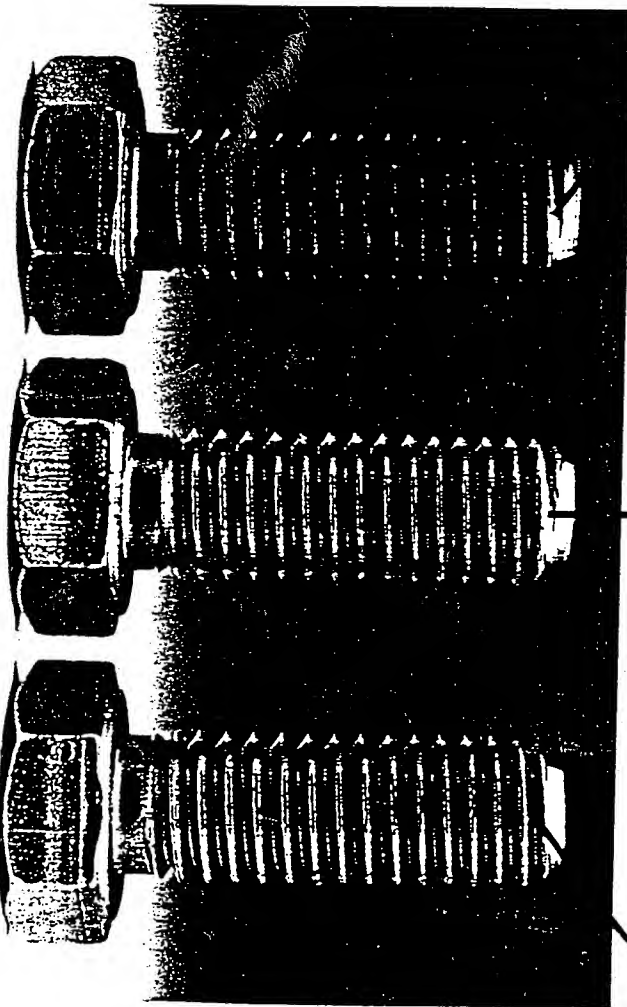


Substrate: Zinc-plated screws

Blue chromation:	Left picture half
Invention:	Center
Yellow chromation:	Right picture half

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FIG. 2



00171558-032999

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Fig. 3

Bandwidth of iridescence according to the present invention
(on zinc-plated screws)

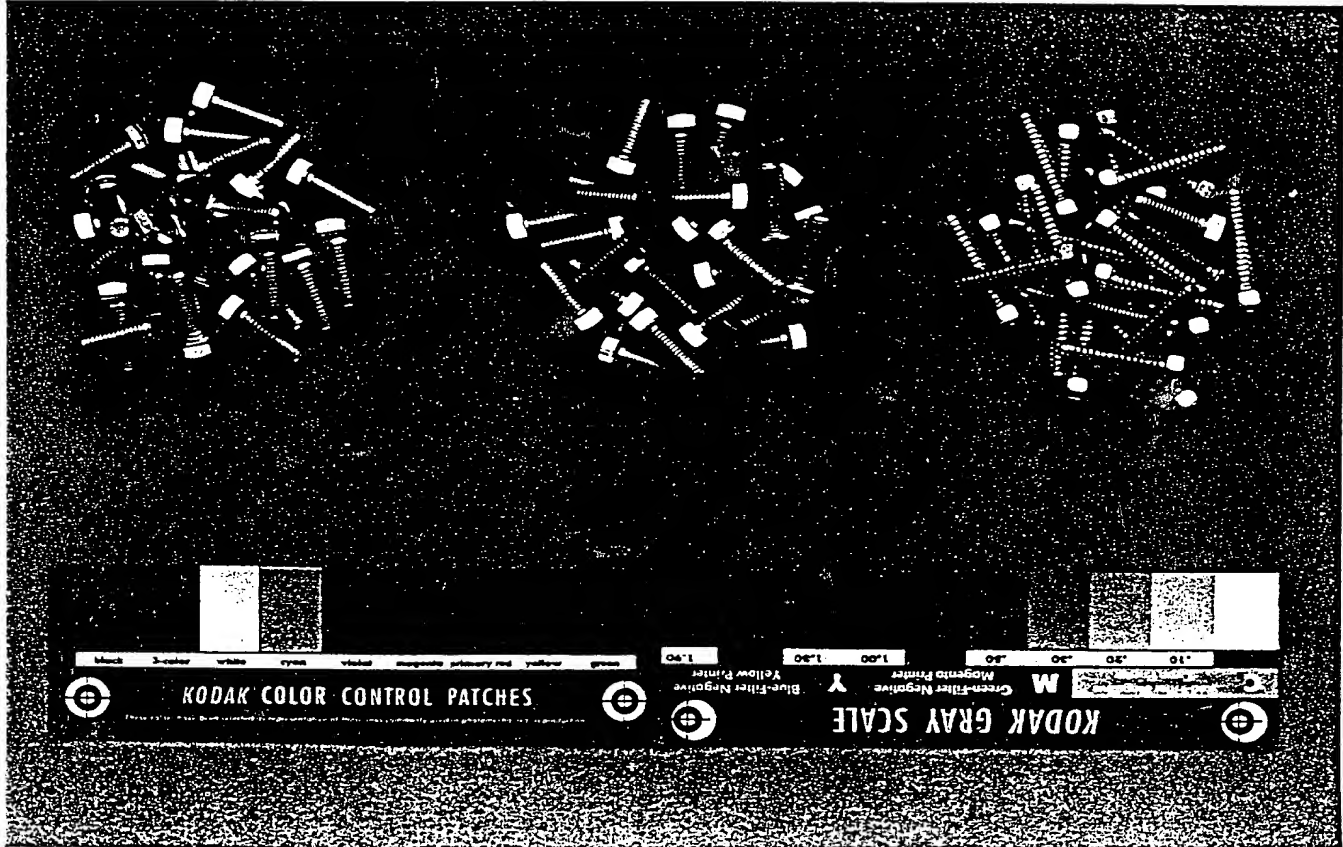
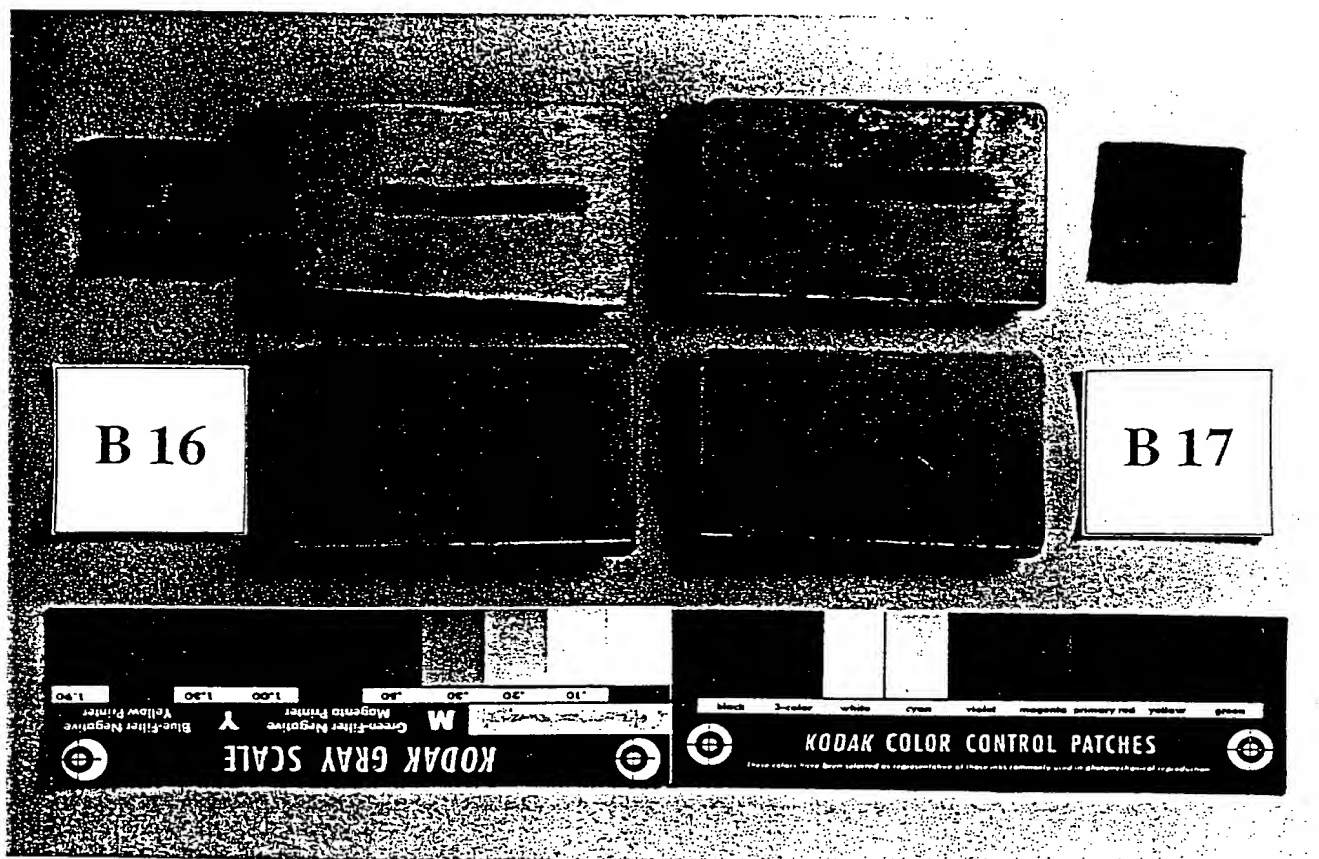


Fig. 4

Comparison test with EP 0 034 040

Example 16

Example 17

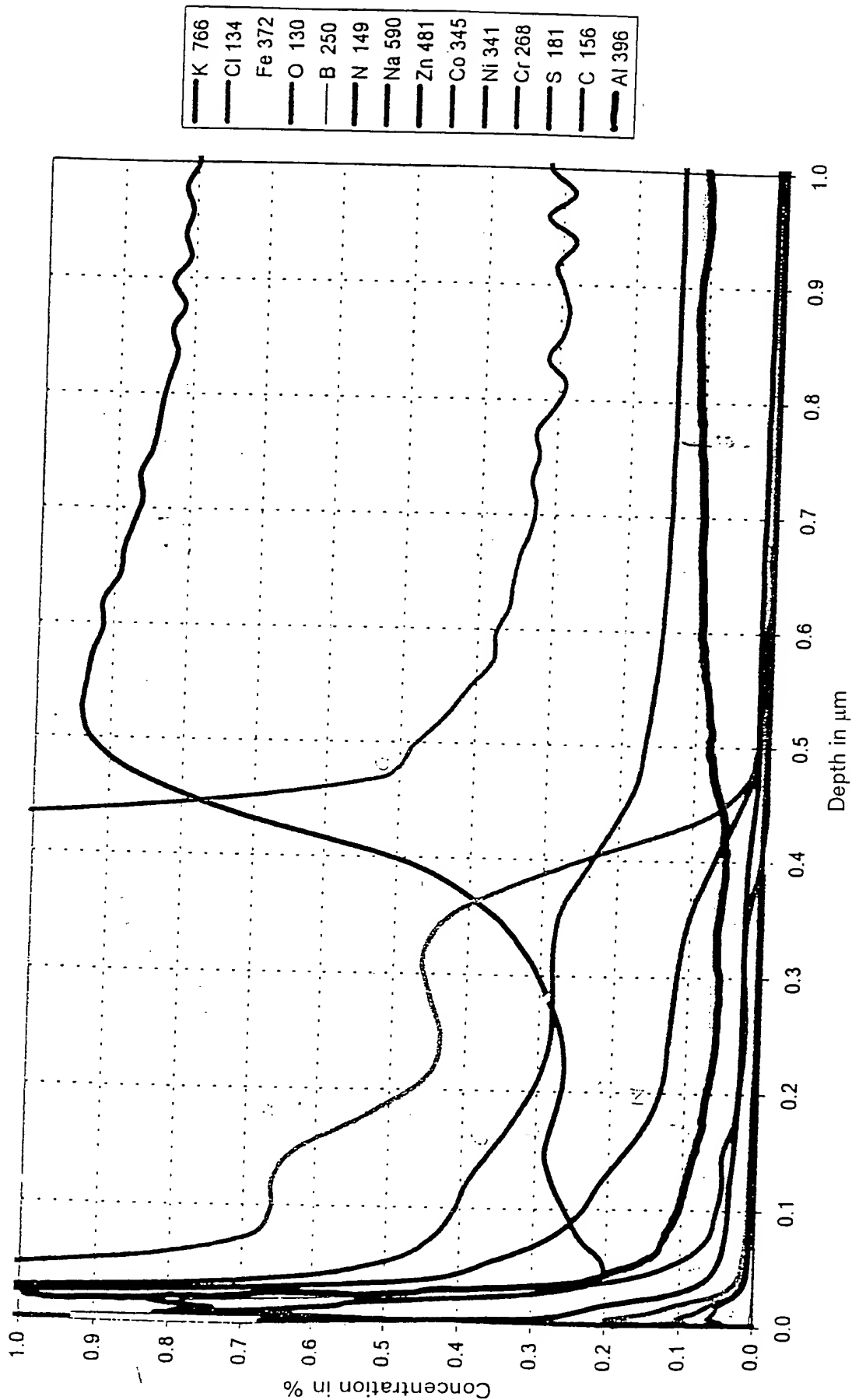


The upper picture half, one the outer left and right, shows a black cloth whereby the abrasions on the metal sheets shown in the top picture half were obtained. Layer portions - discernible as whitish stains - are on both pieces of cloth. The lower picture half shows the unmarred layers of the prior art.

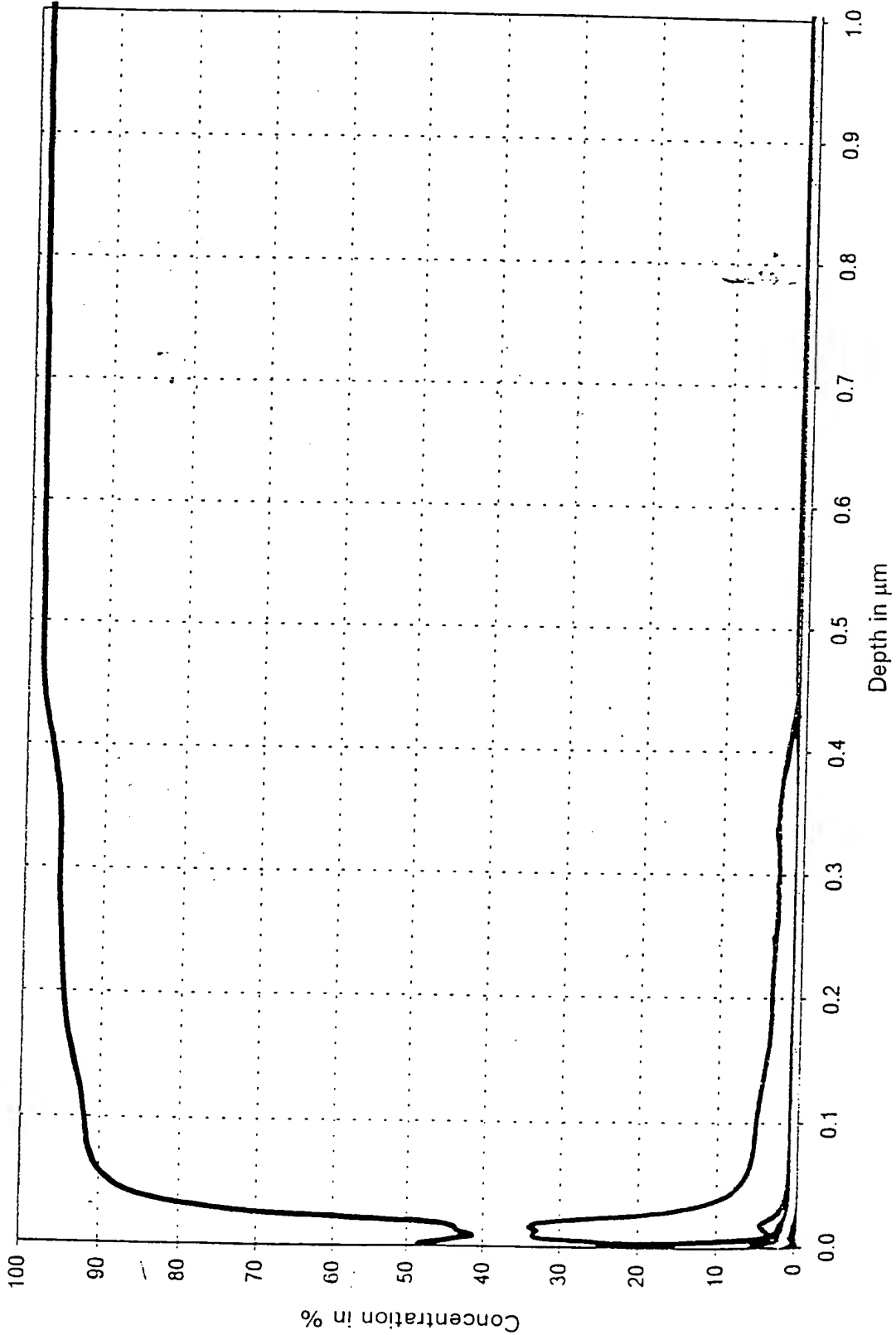
Substrate: Zinc-plated steel sheet.

FIG. 5

Pattern 1, Measurement Position A



—	K 766
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 268
—	S 181
—	C 156
—	Al 396

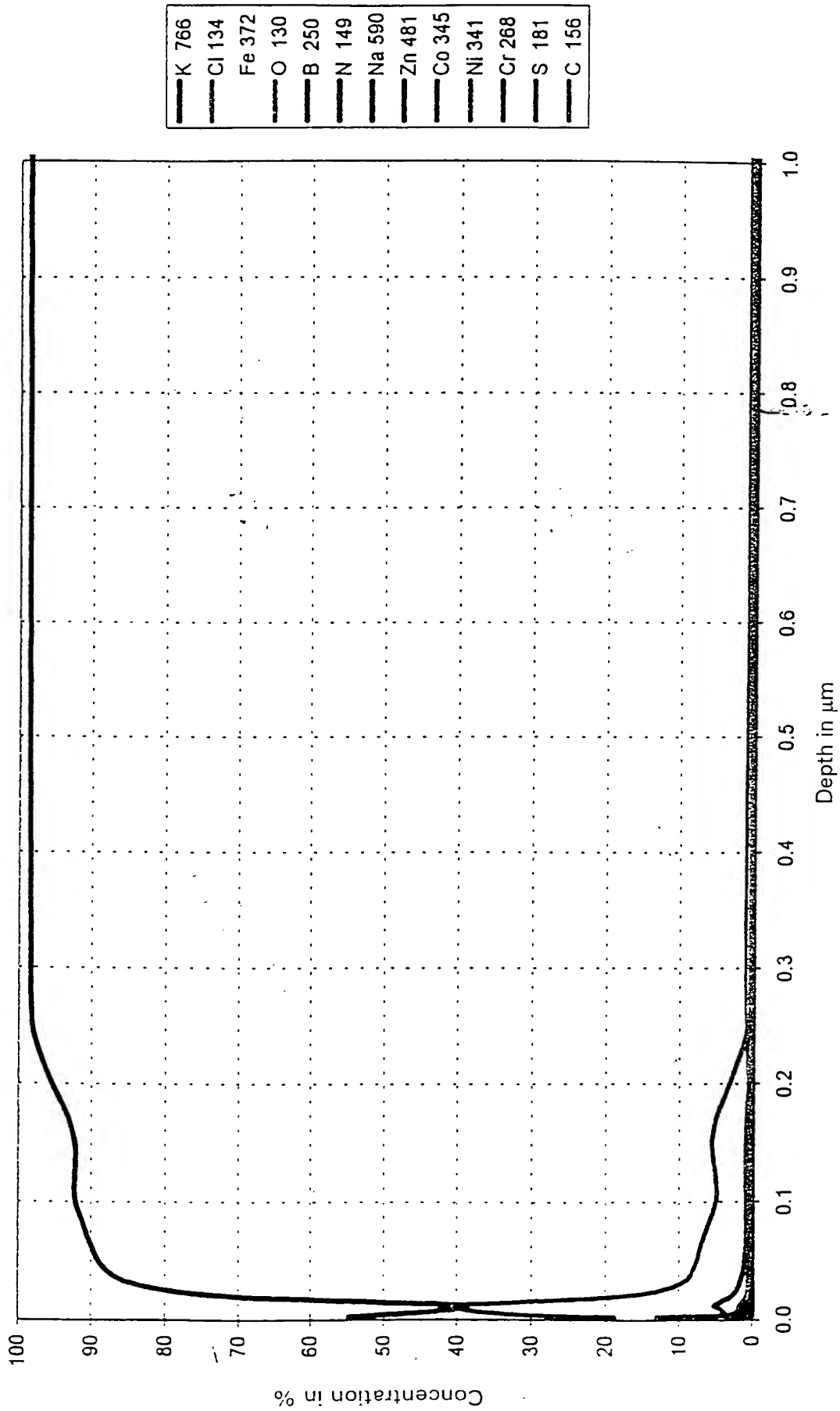


Pattern 1, Measurement Position A

Diagram 2

Diagram 1

Sample 1, Measurement Position B



66620-8957260

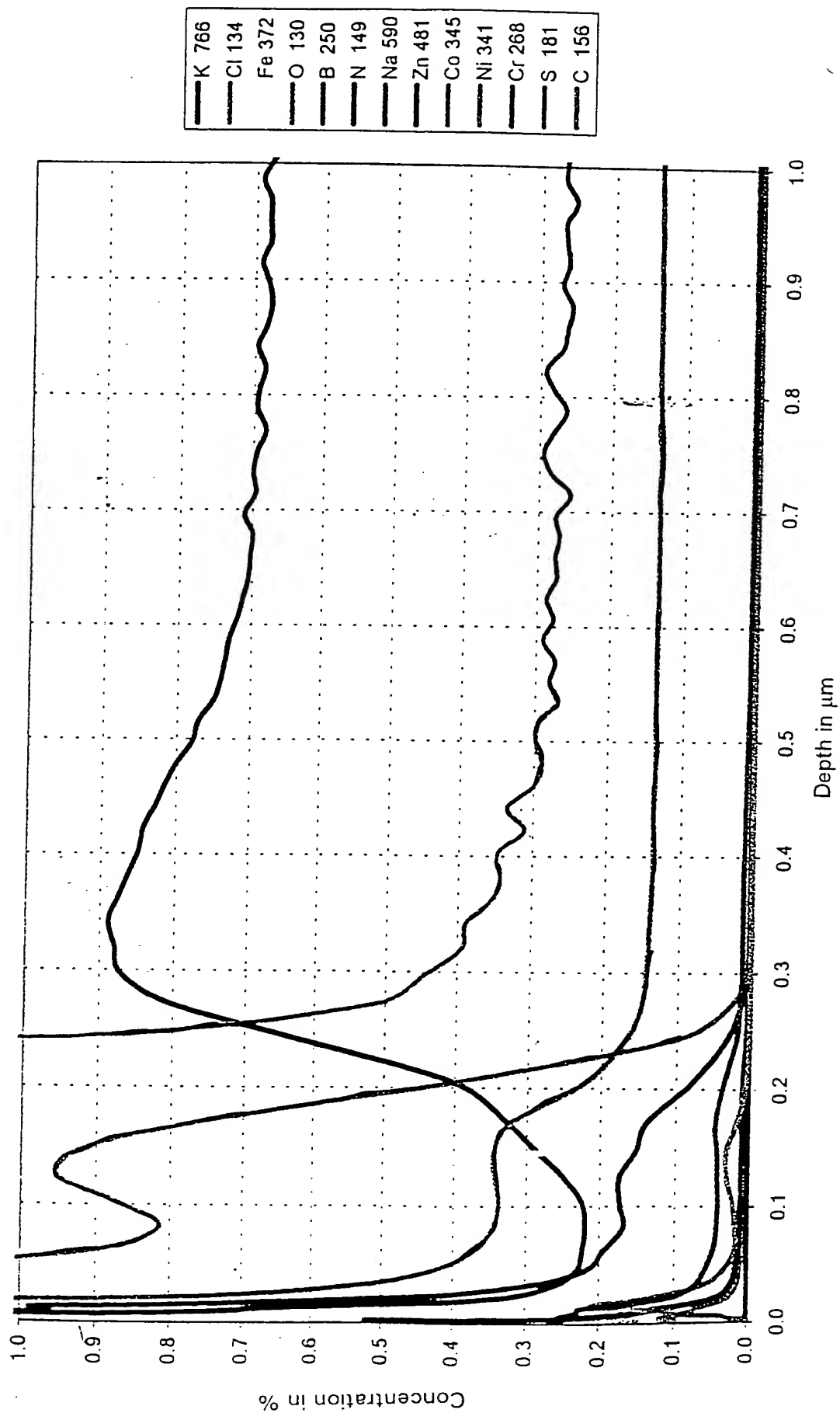
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FIG. 8

Diagram 2

Sample 1, Measurement Position B



00000 8551260

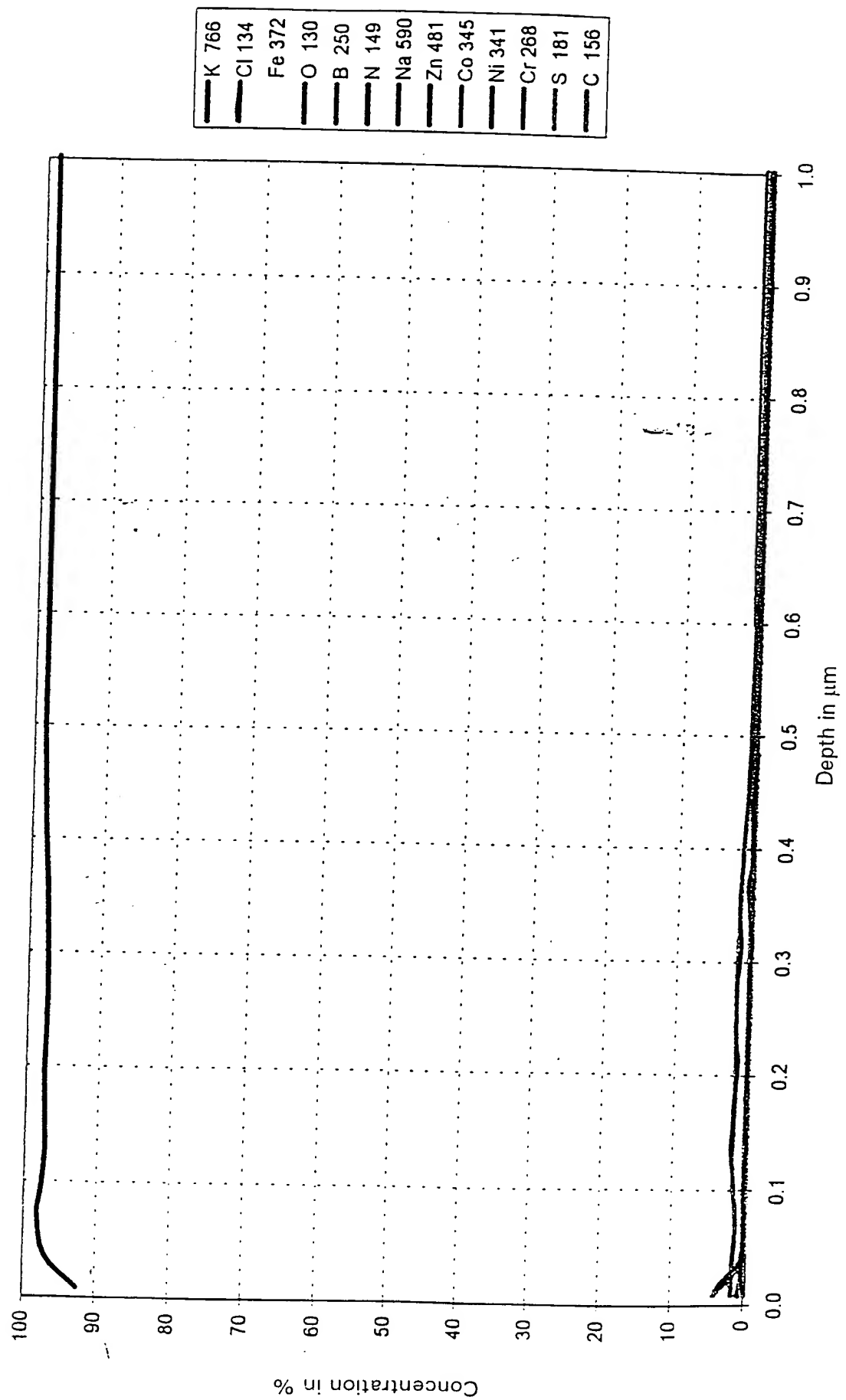
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FIG. 9

Diagram 1

Sample 2, Measurement Position A



66620-8551260

Diagram 2

Sample 2, Measurement Position A

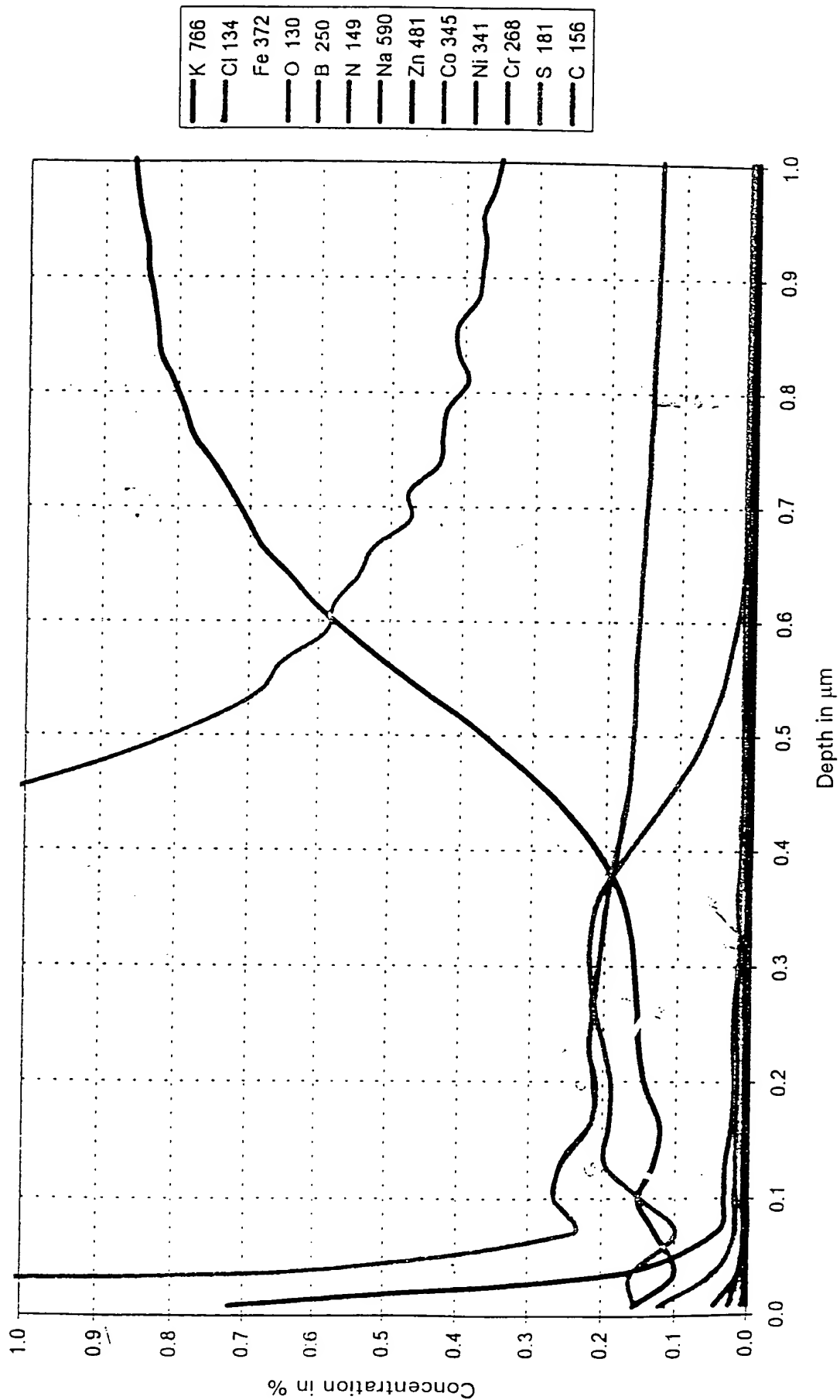


Diagram 1

Sample 2, Measurement Position B

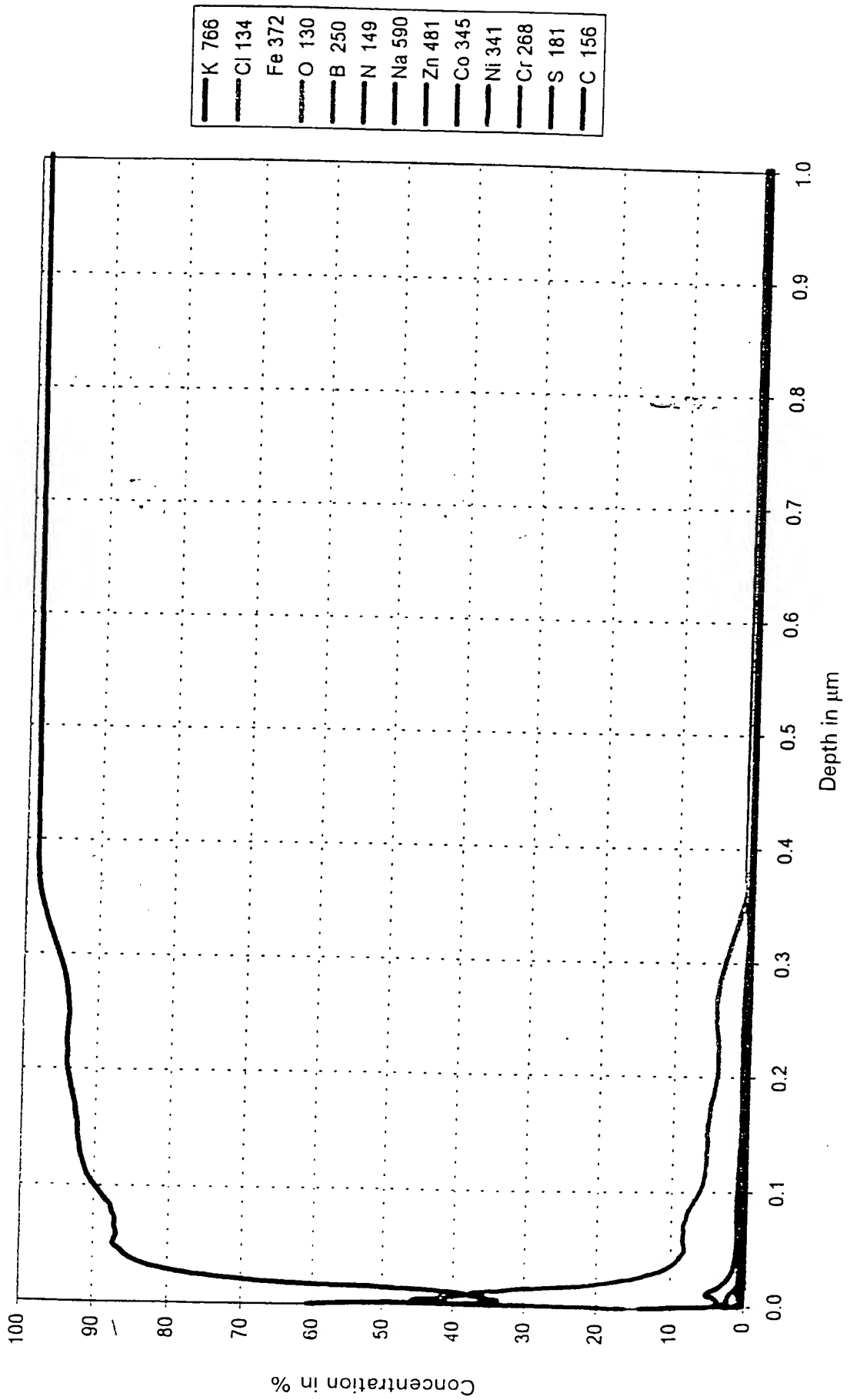
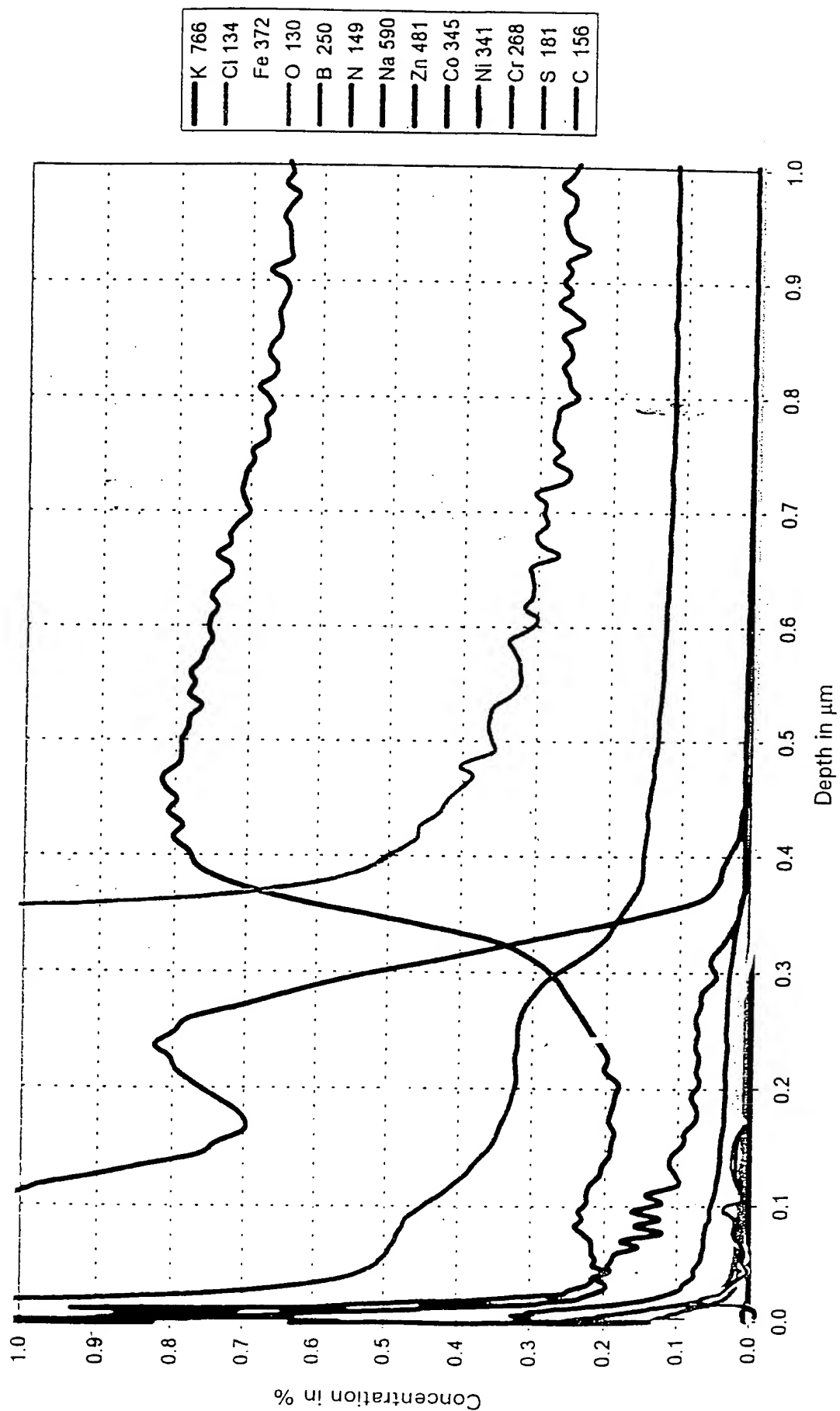
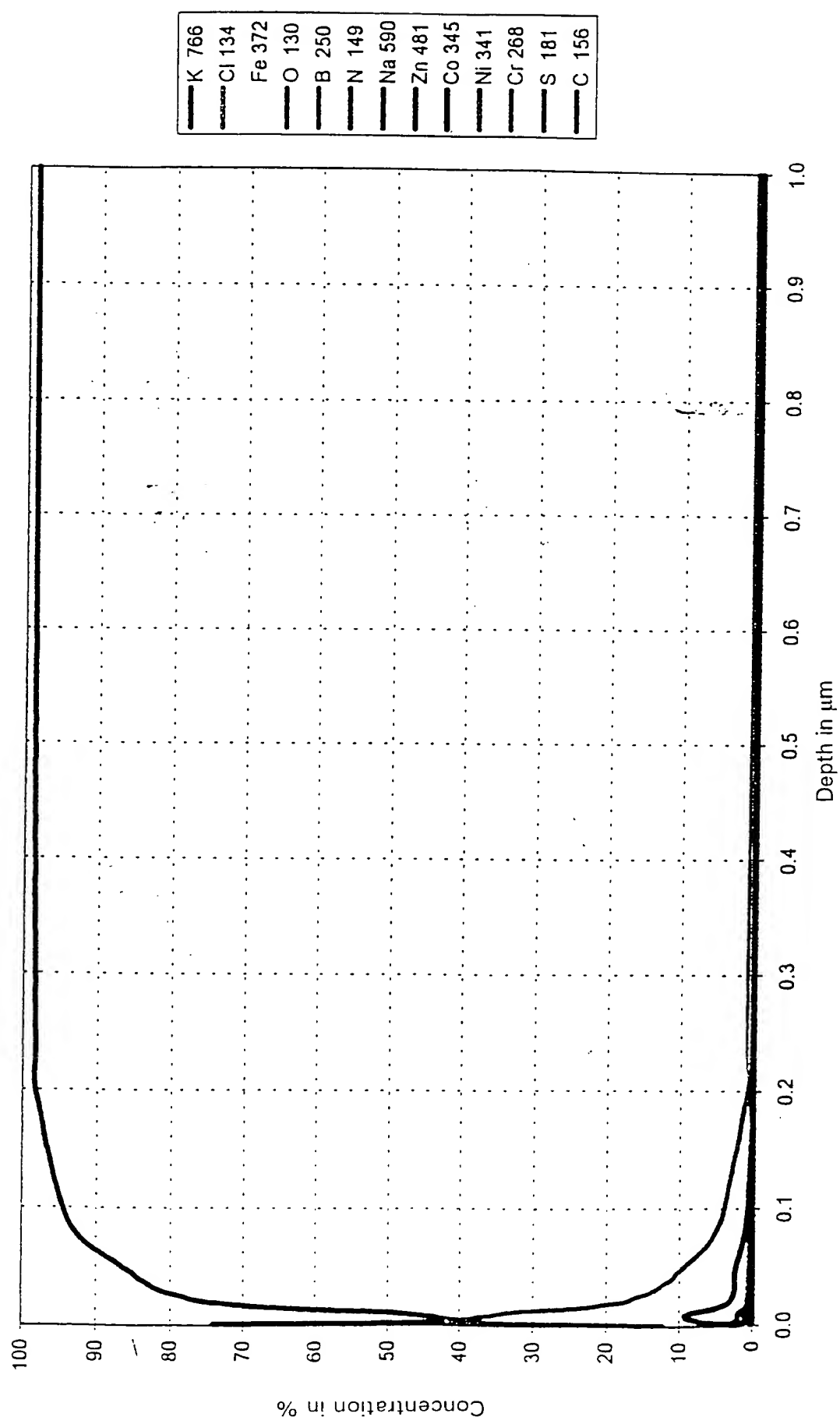


Diagram 2

Sample 2, Measurement Position B



Sample 3, Measurement Position A



Sample 3, Measurement Position A

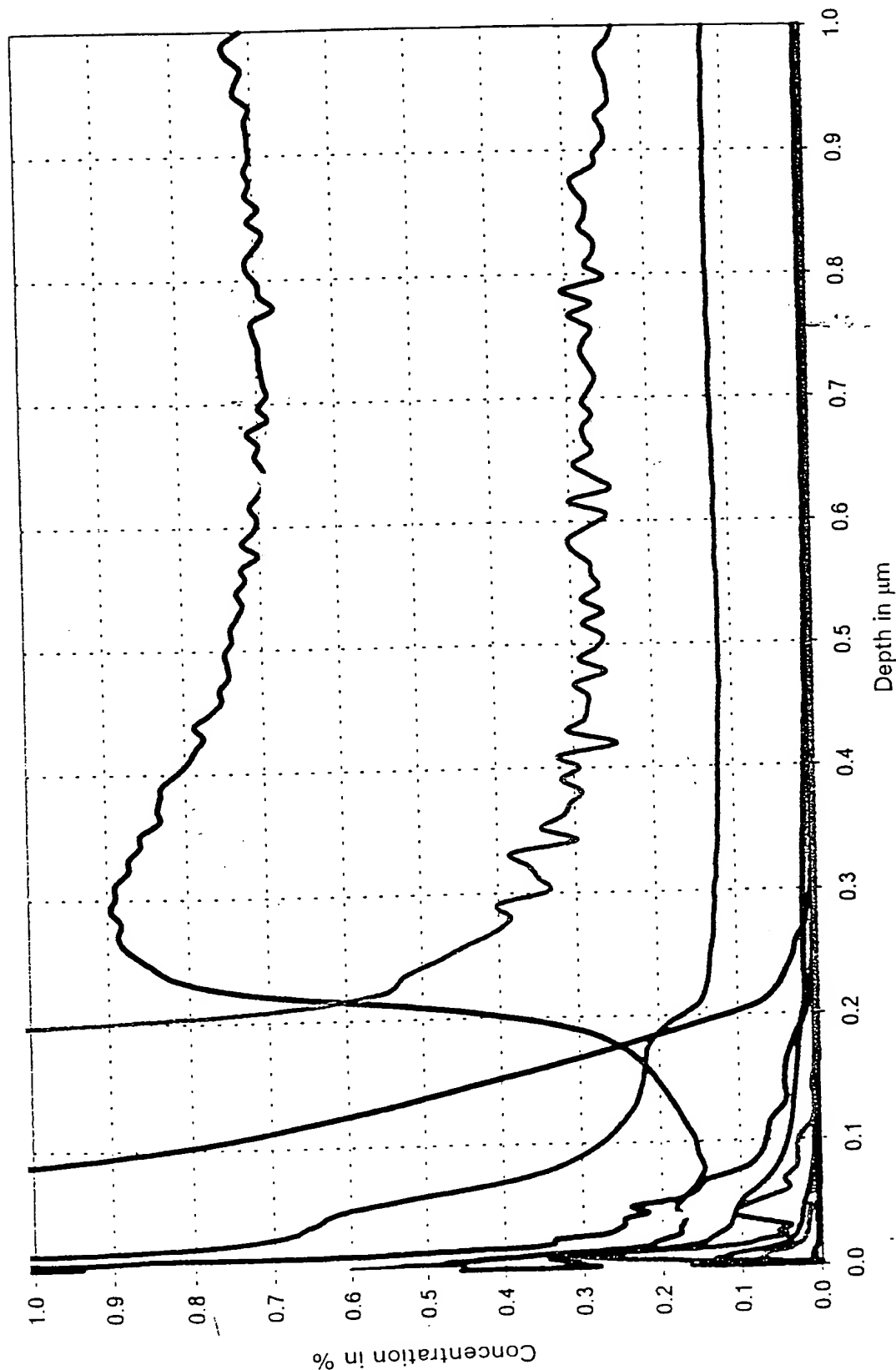
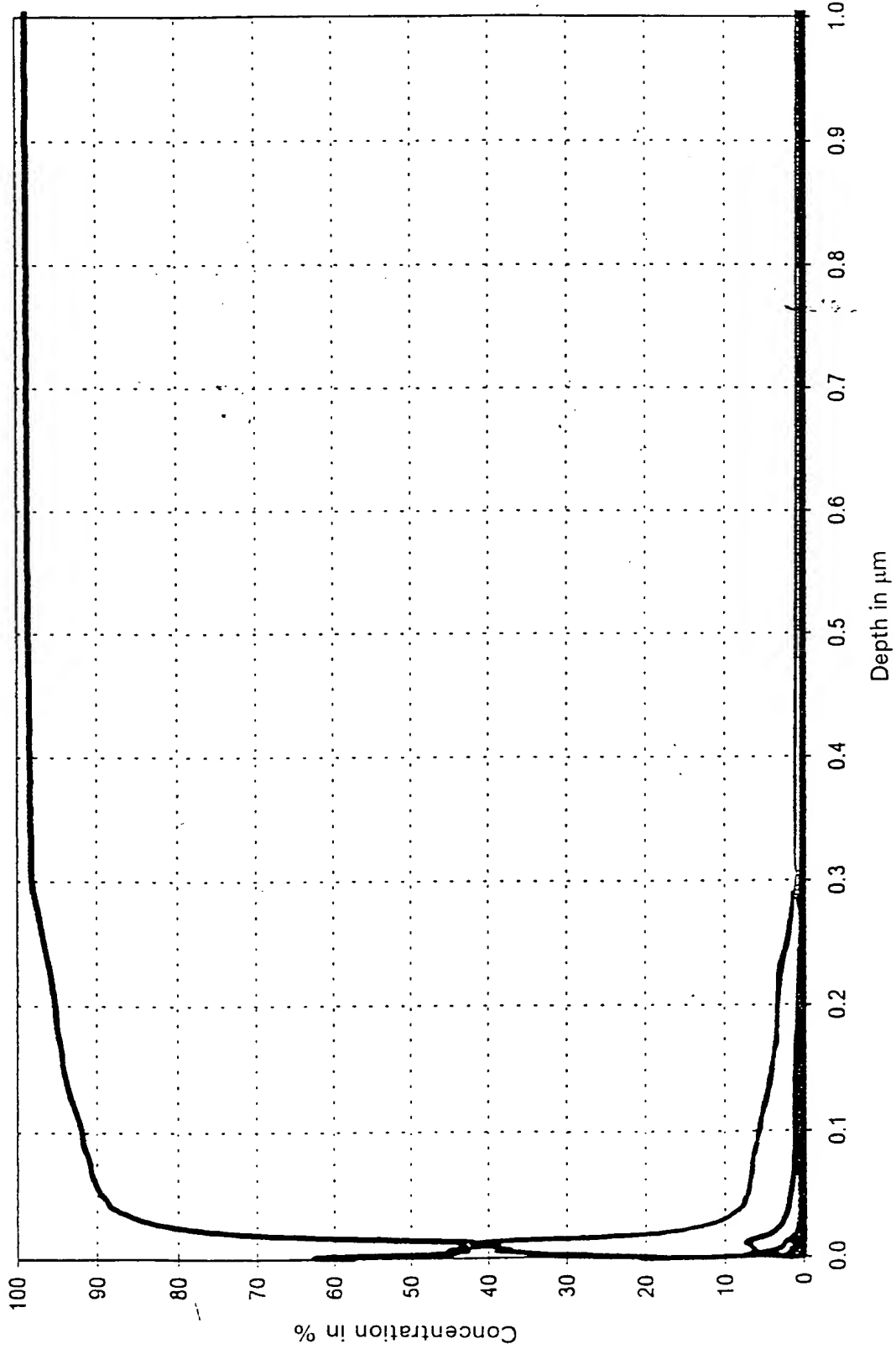


Diagram 1 0551260

Sample 4, Measurement Position A



—	K 766
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 268
—	S 181
—	C 156

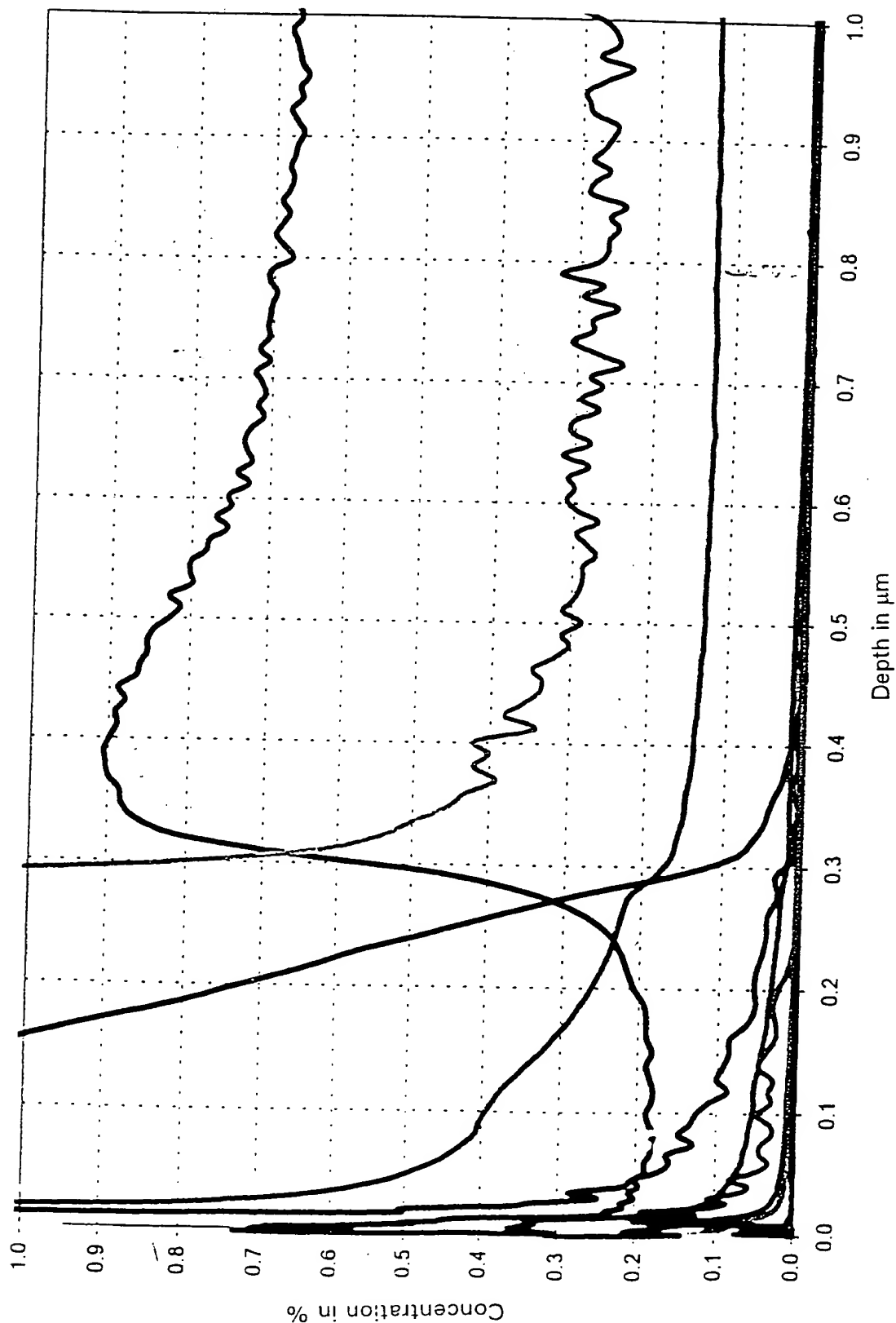
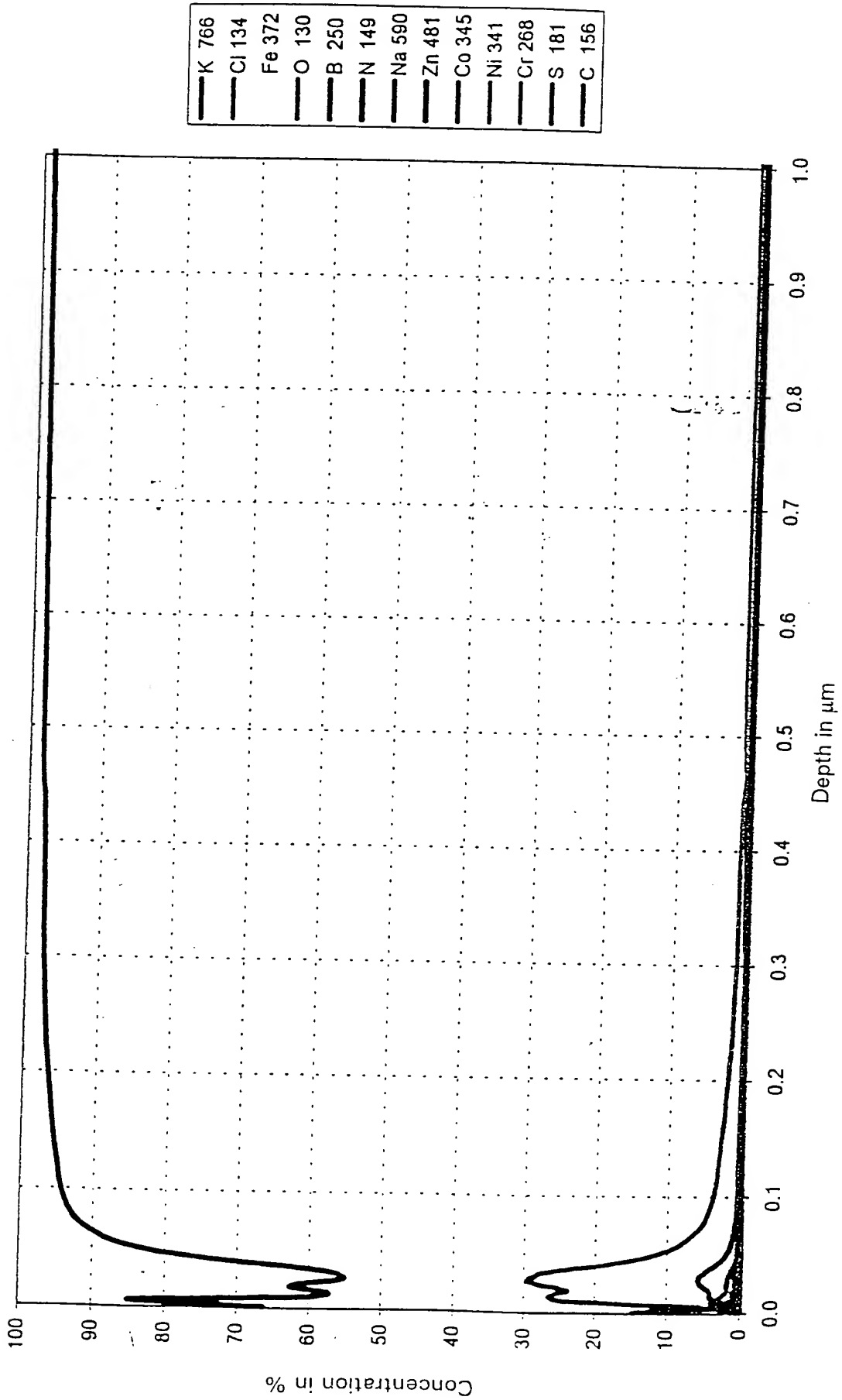


FIG. 16

Sample 4, Measurement Position A

Diagram 2

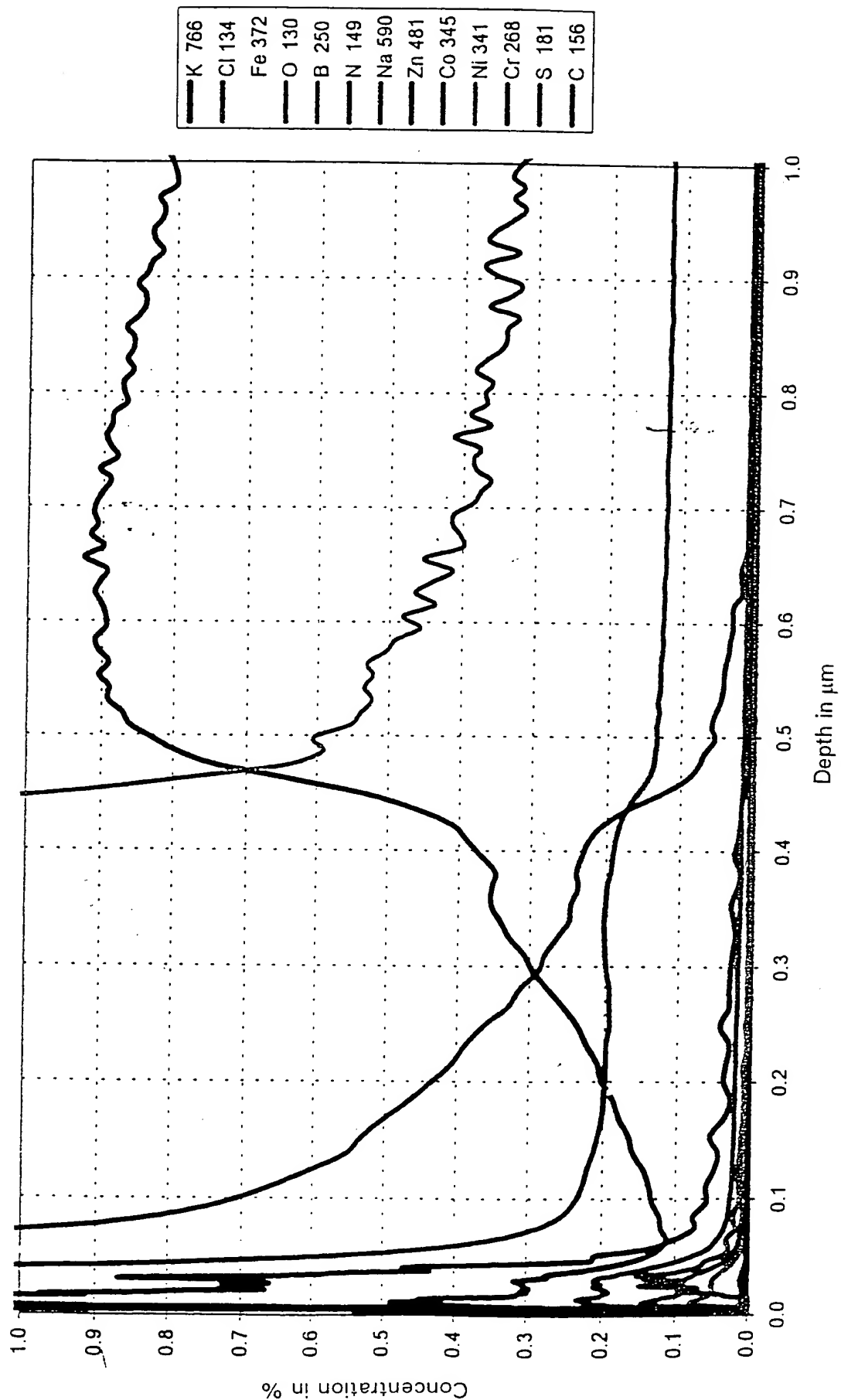
Sample 5, Measurement Position A



[illegible]

Diagram 2

Sample 5, Measurement Position A



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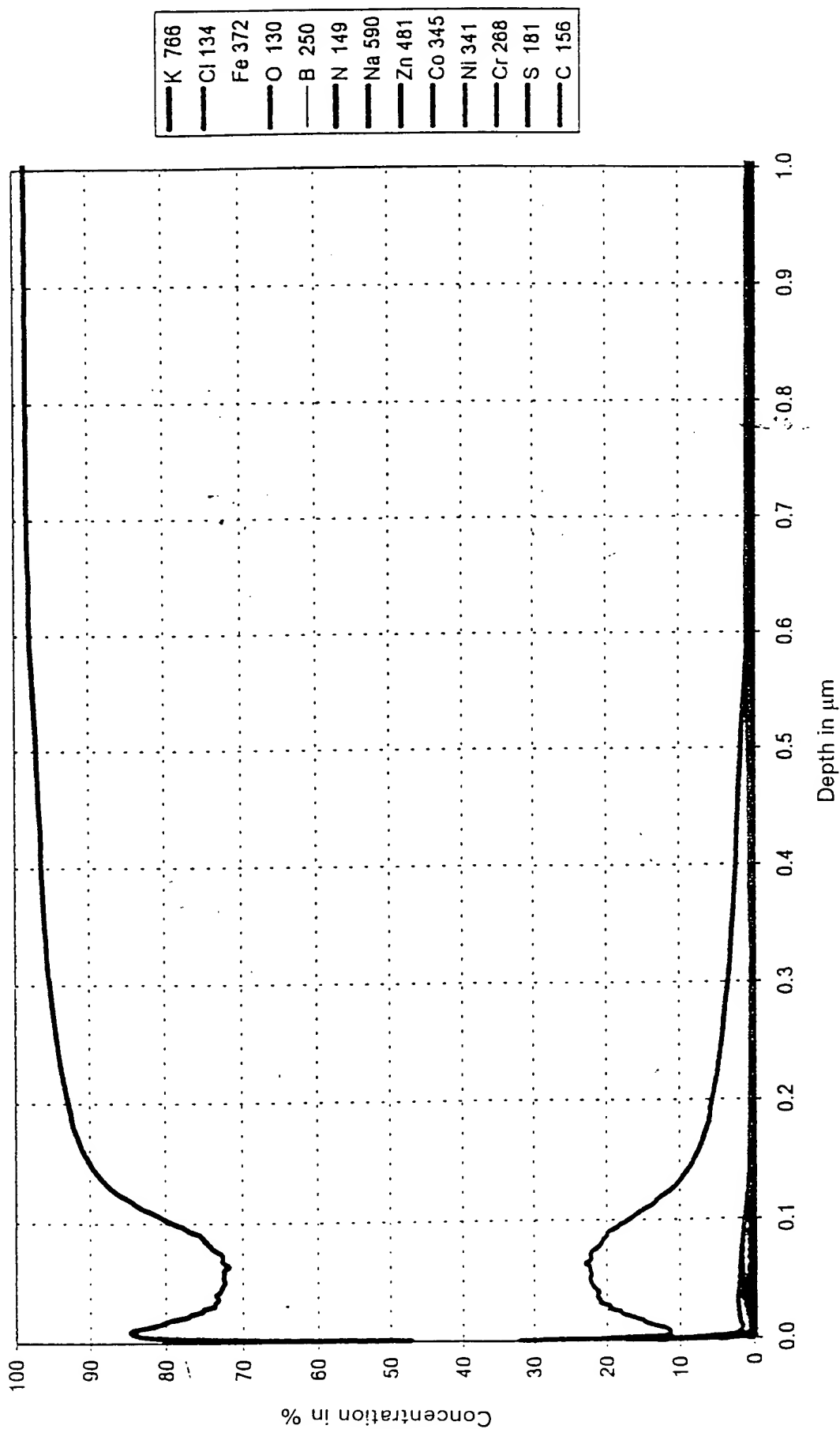
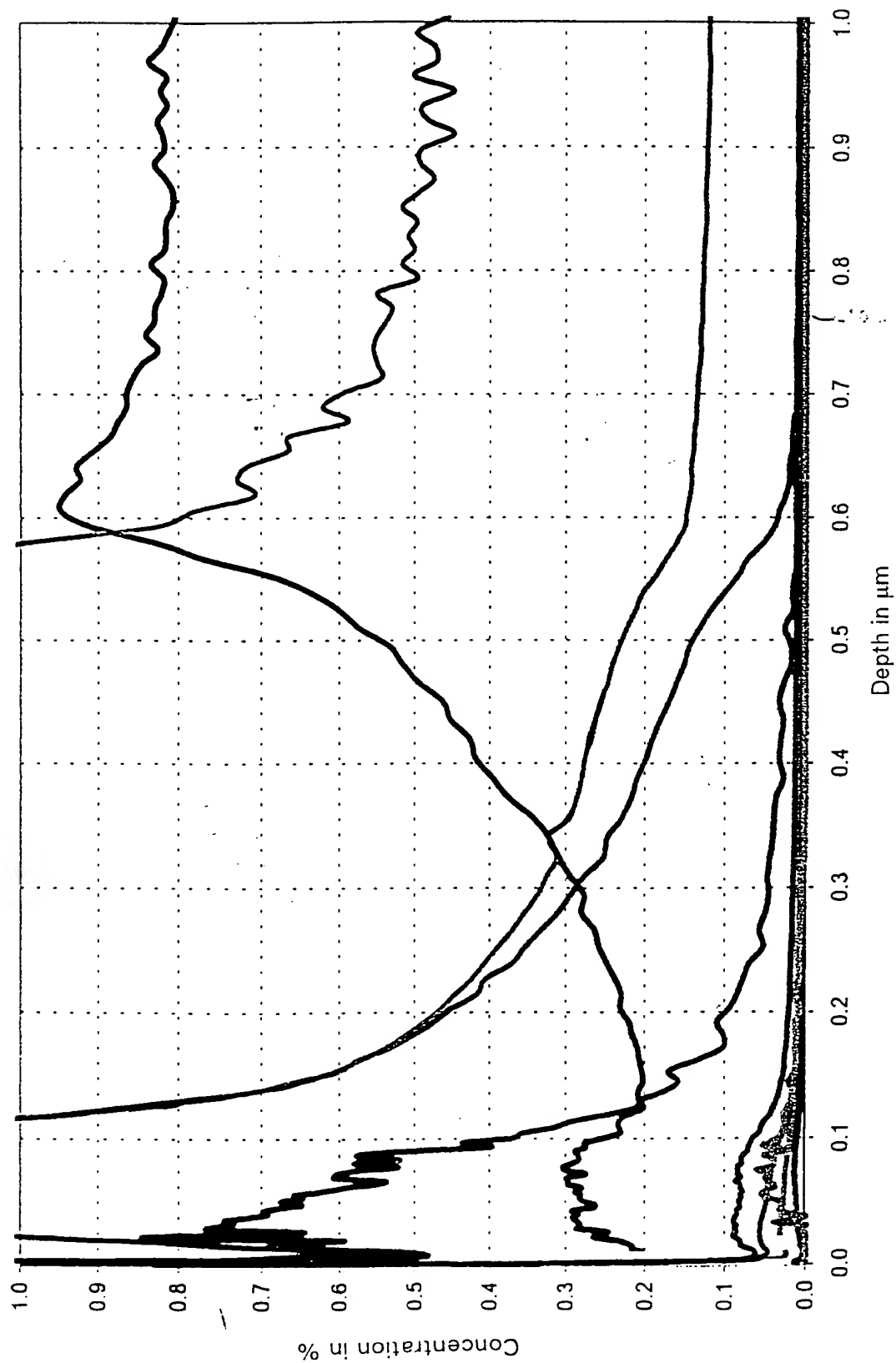


Diagram 1
00000-05512160

Sample 6, Measurement Position A



Sample 6, Measurement Position B

FIG. 21

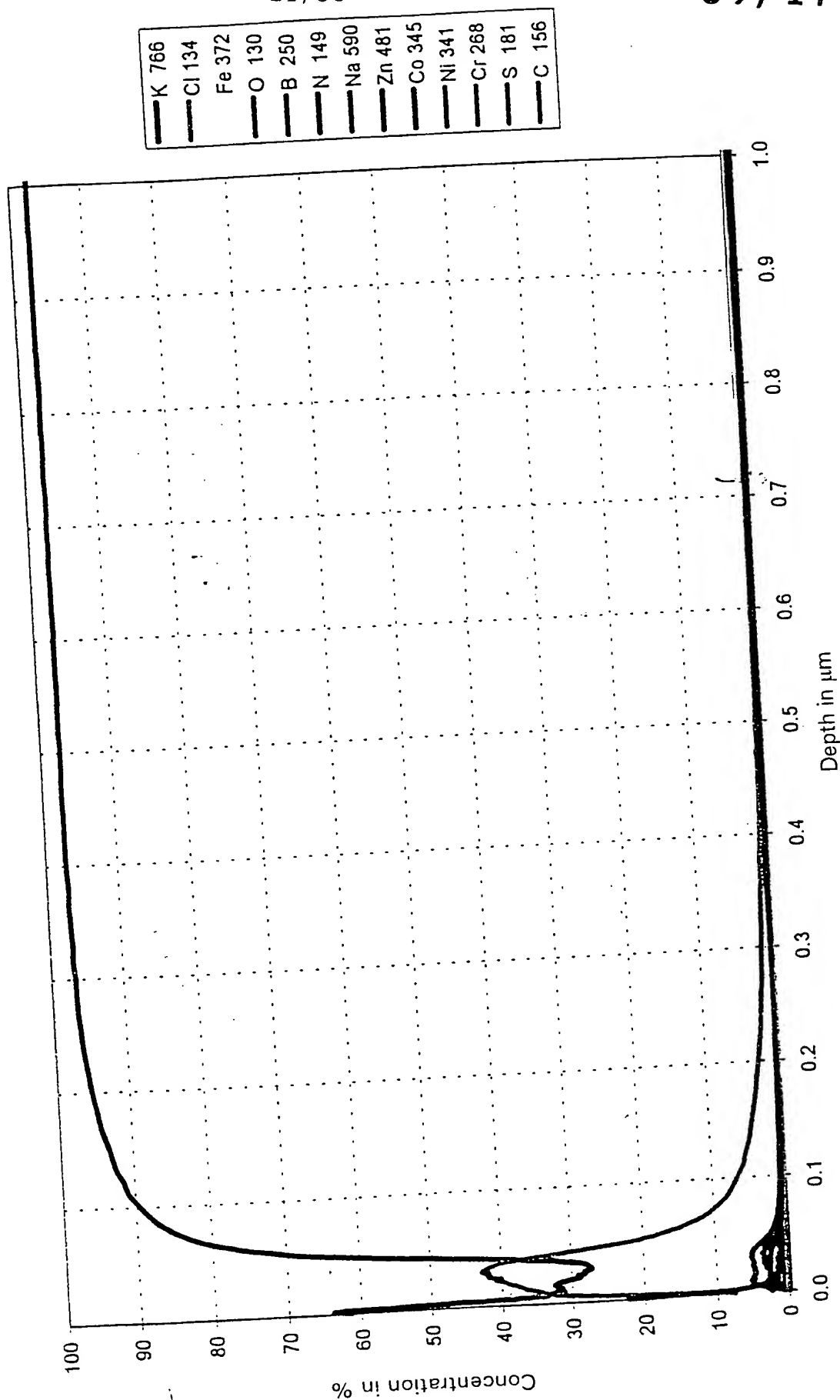
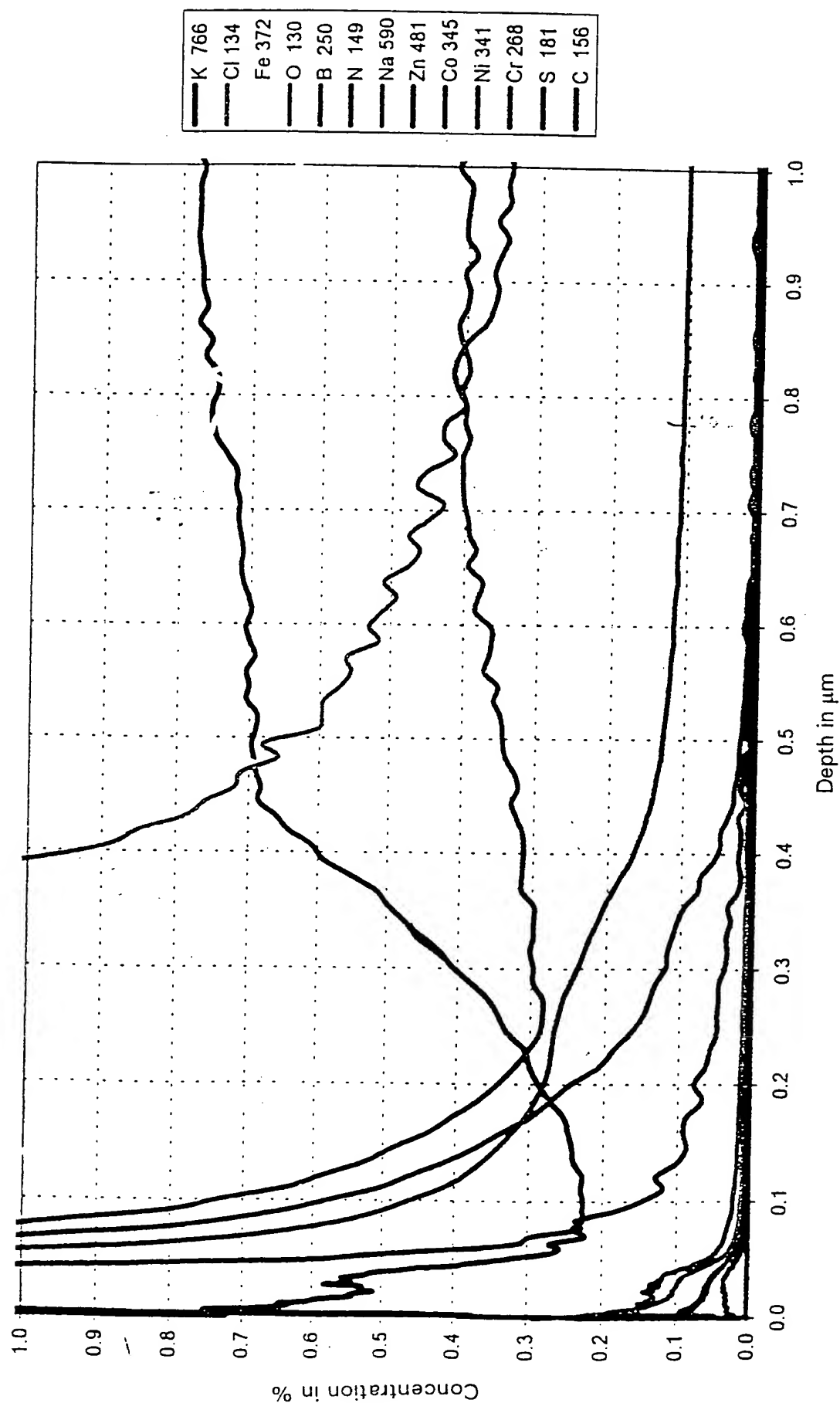
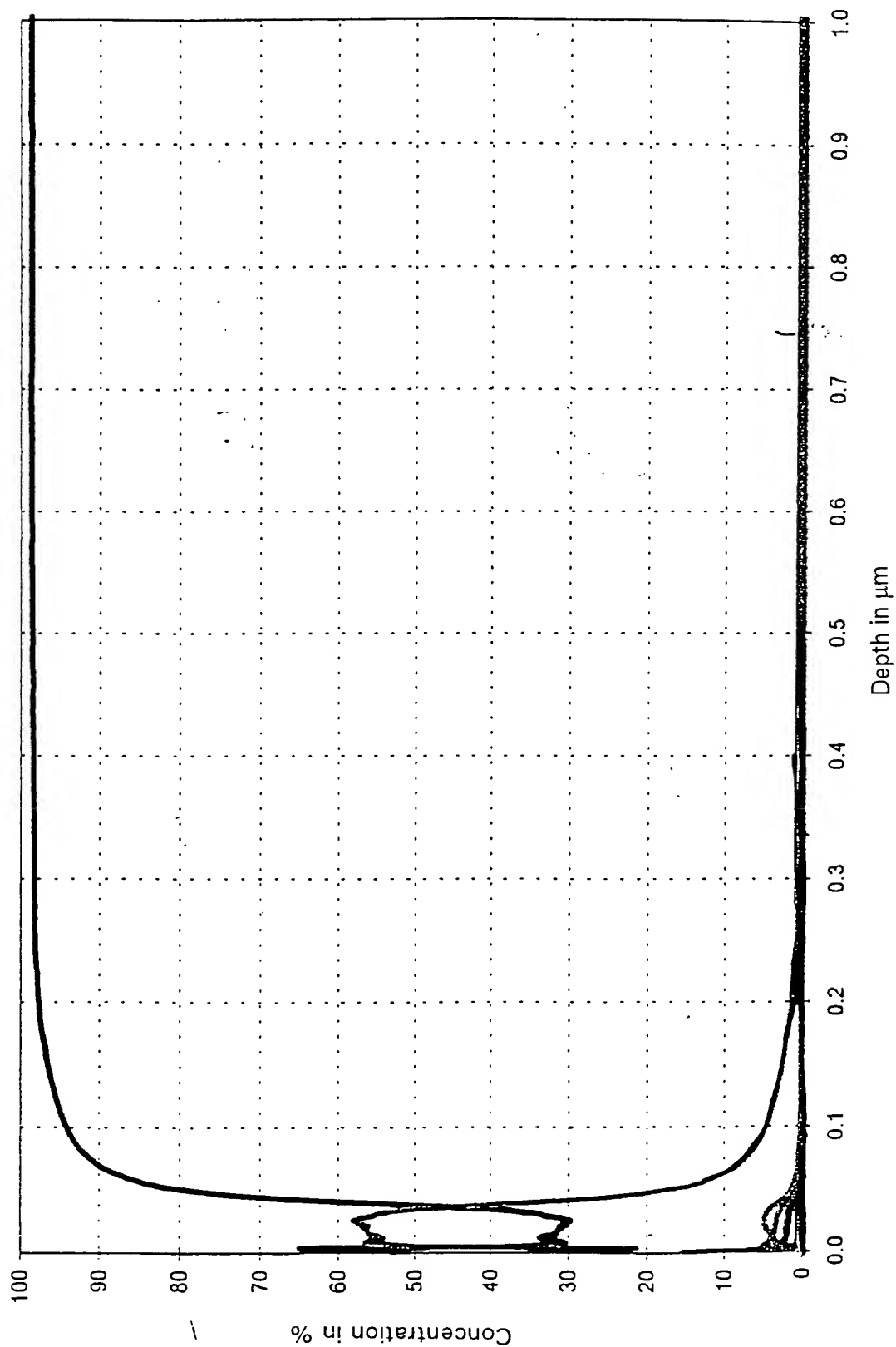


FIG. 22

Sample 6, Measurement Position B



—	K 766
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 268
—	S 181
—	C 156



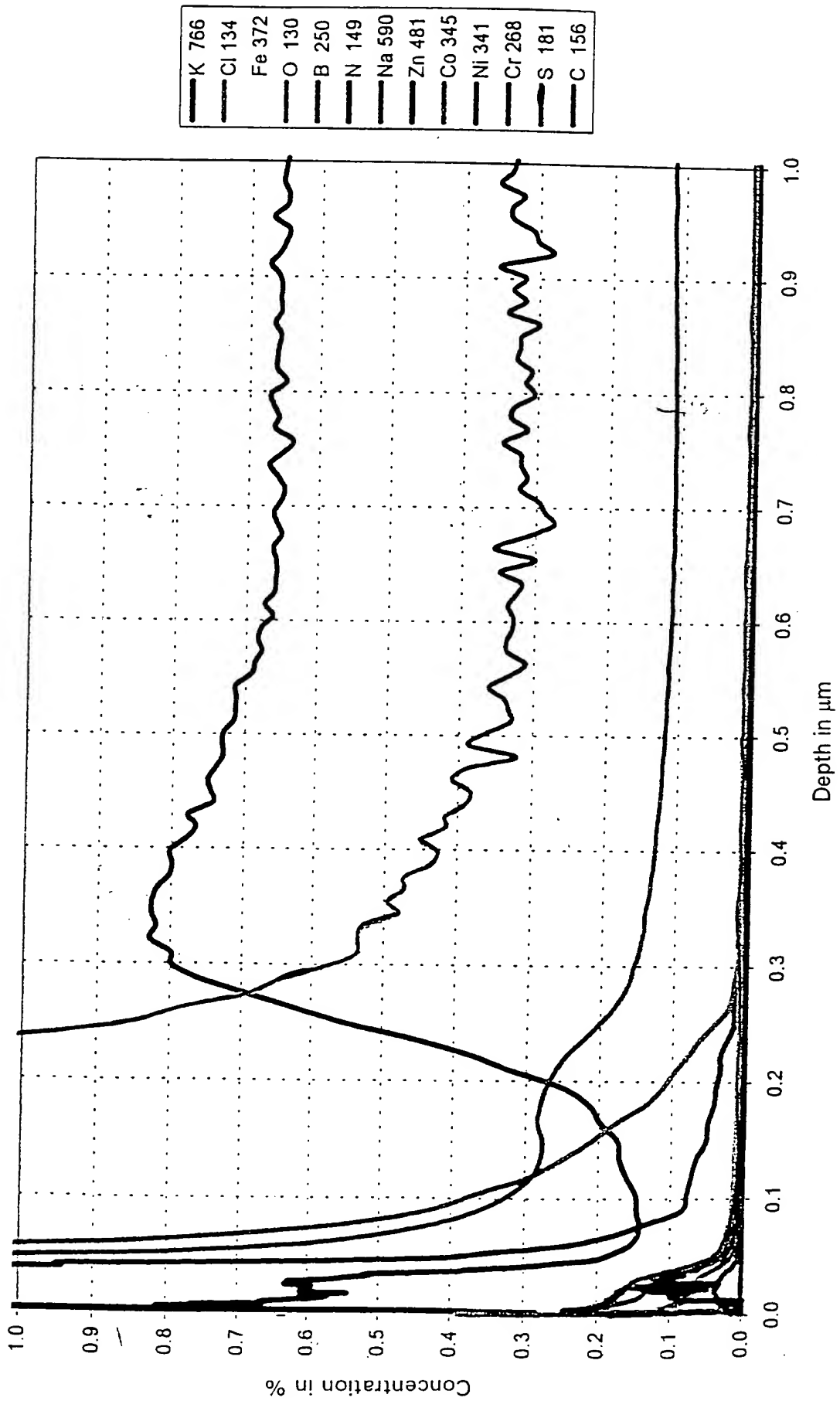
666 Diagram 65574760

Sample 6, Measurement Position C

[illegible]

Diagram 2

Sample 6, Measurement Position C



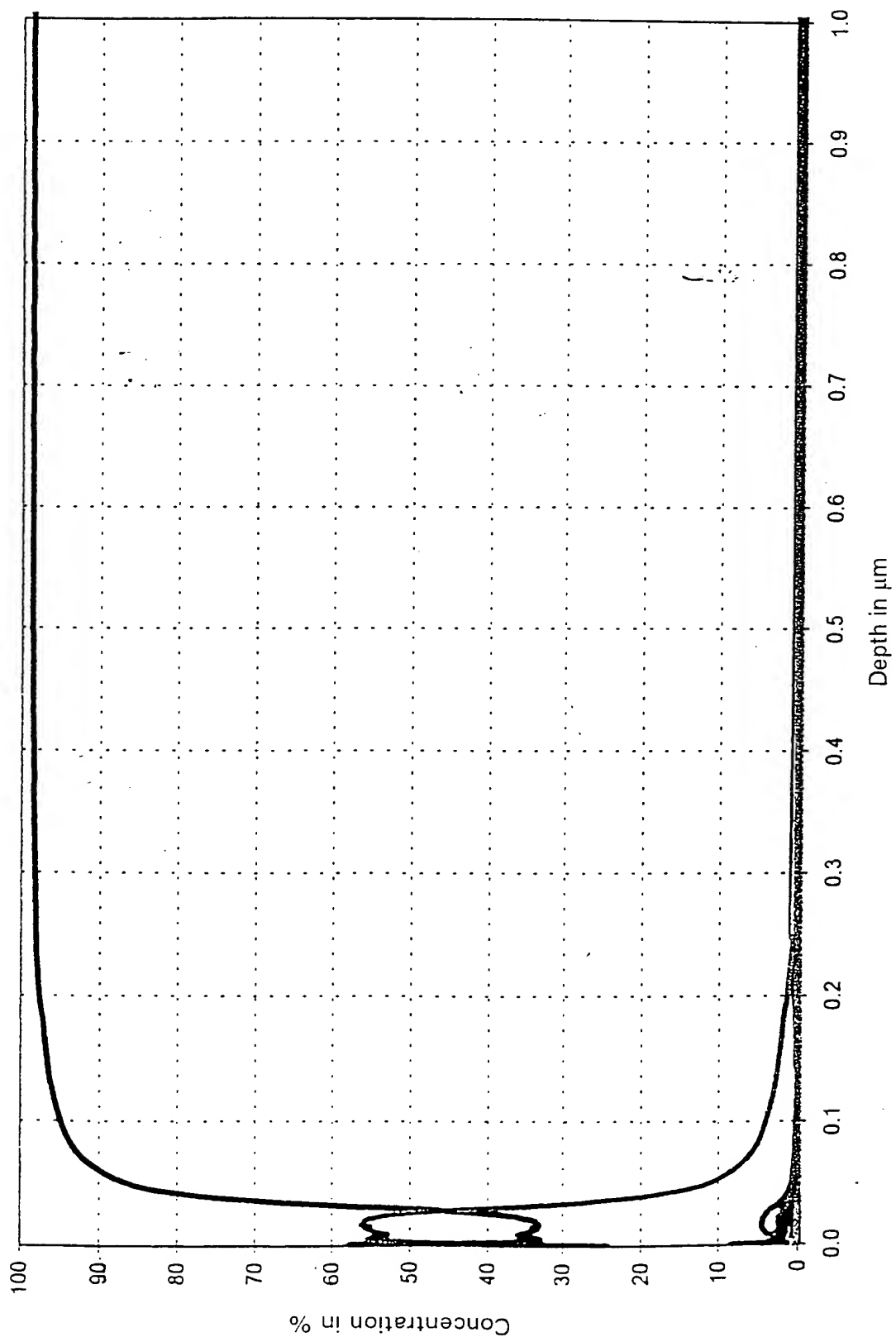
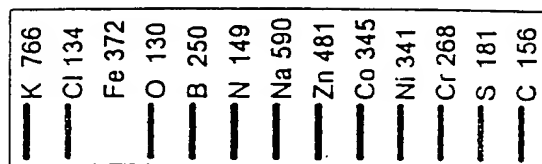


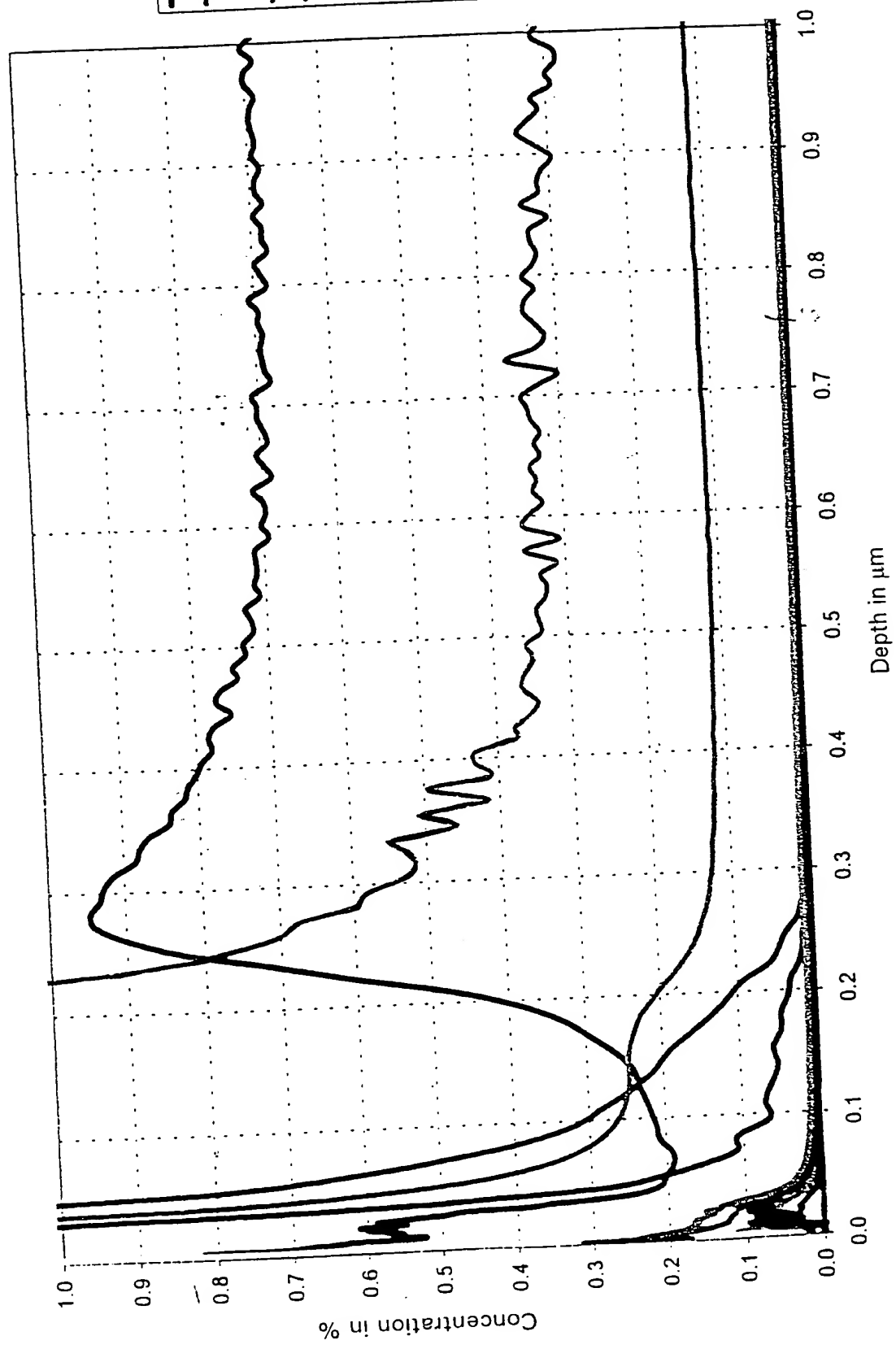
FIG. 25

Diagram 1

Sample 6, Measurement Position D

Sample 6, Measurement Position D

FIG. 26



— K 766	Fe 372
— Cl 134	— O 130
	— B 250
	— N 149
	— Na 590
	— Zn 481
	— Co 345
	— Ni 341
	— Cr 268
	— S 181
	— C 156

☐ K 766
☐ Cl 134
☐ Fe 372
☐ O 130
☐ B 250
☐ N 149
☐ Na 590
☐ Zn 481
☐ Co 345
☐ Ni 341
☐ Cr 268
☐ S 181
☐ C 156

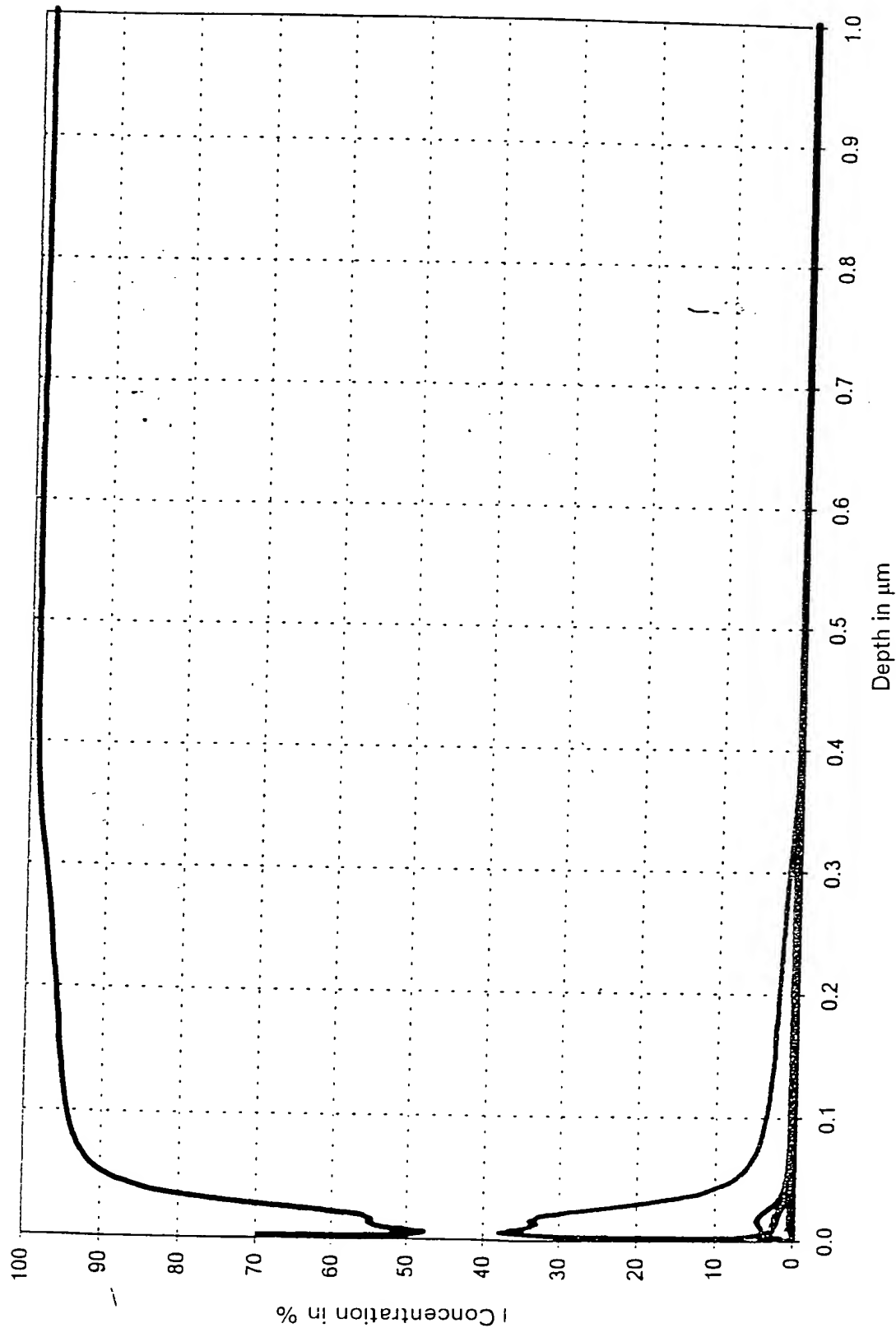


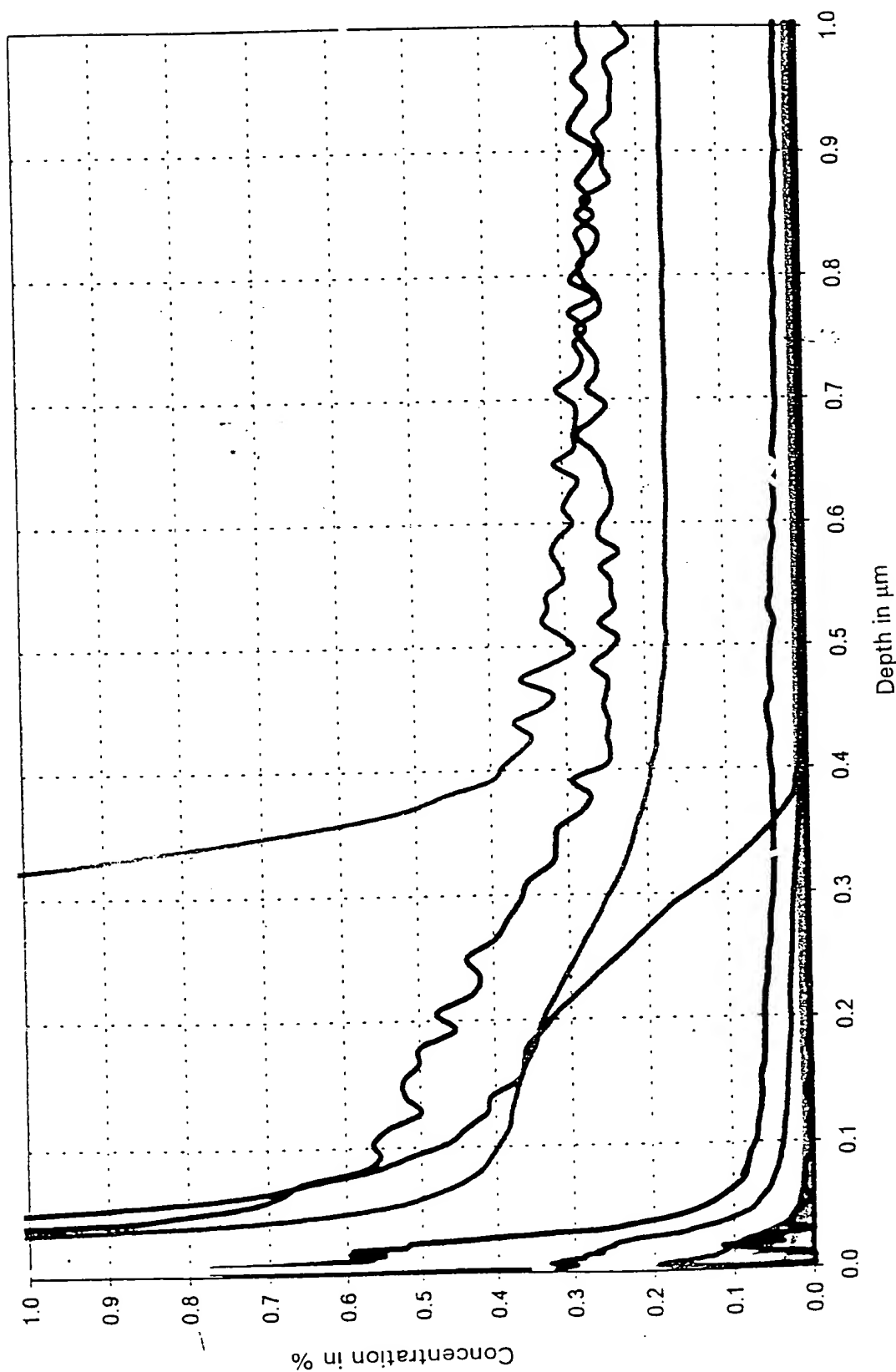
FIG. 27

Diagram 1

Sample 7, Measurement Position A

[illegible]

Sample 7, Measurement Position A



☐ K 766
☐ Cl 134
 Fe 372
☐ O 130
☐ B 250
☐ N 149
☐ Na 590
☐ Zn 481
☐ Co 345
☐ Ni 341
☐ Cr 268
☐ S 181
☐ C 156

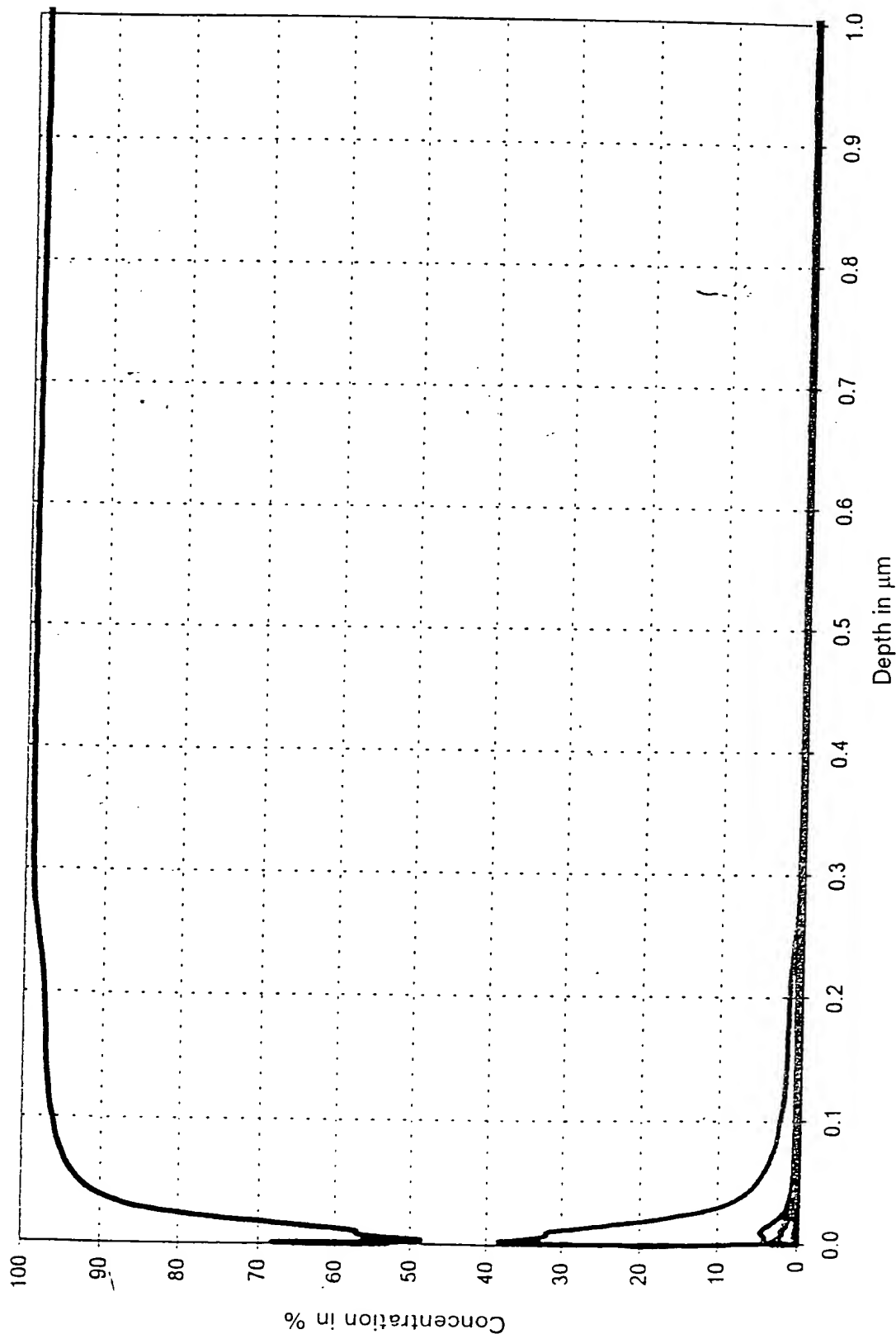


FIG. 29

Diagram 1

Sample 7, Measurement Position B

—	K 766
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 268
—	S 181
—	C 158

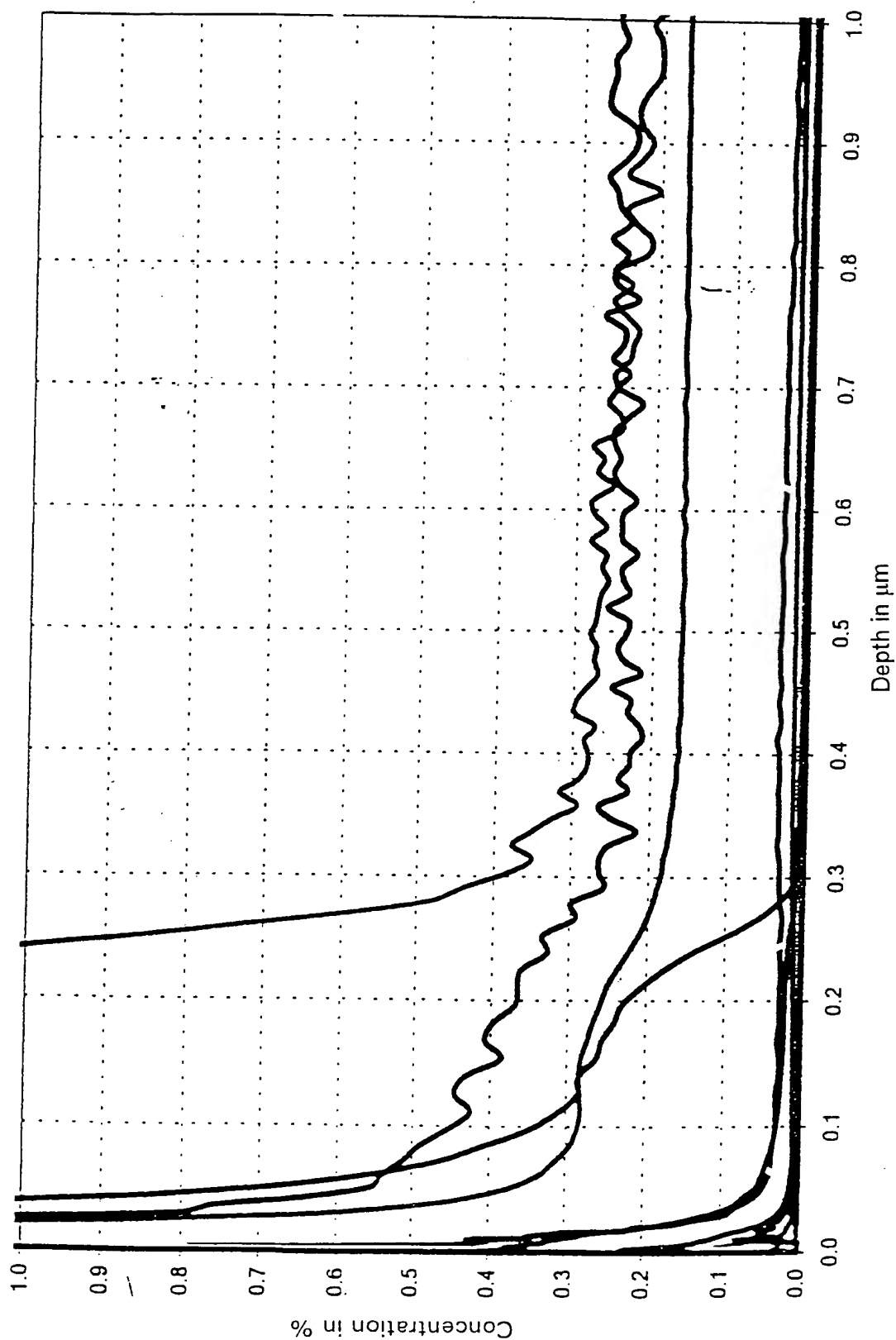


FIG. 30

Sample 7, Measurement Position B

Diagram 2

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—	K 766
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 268
—	S 181
—	C 156

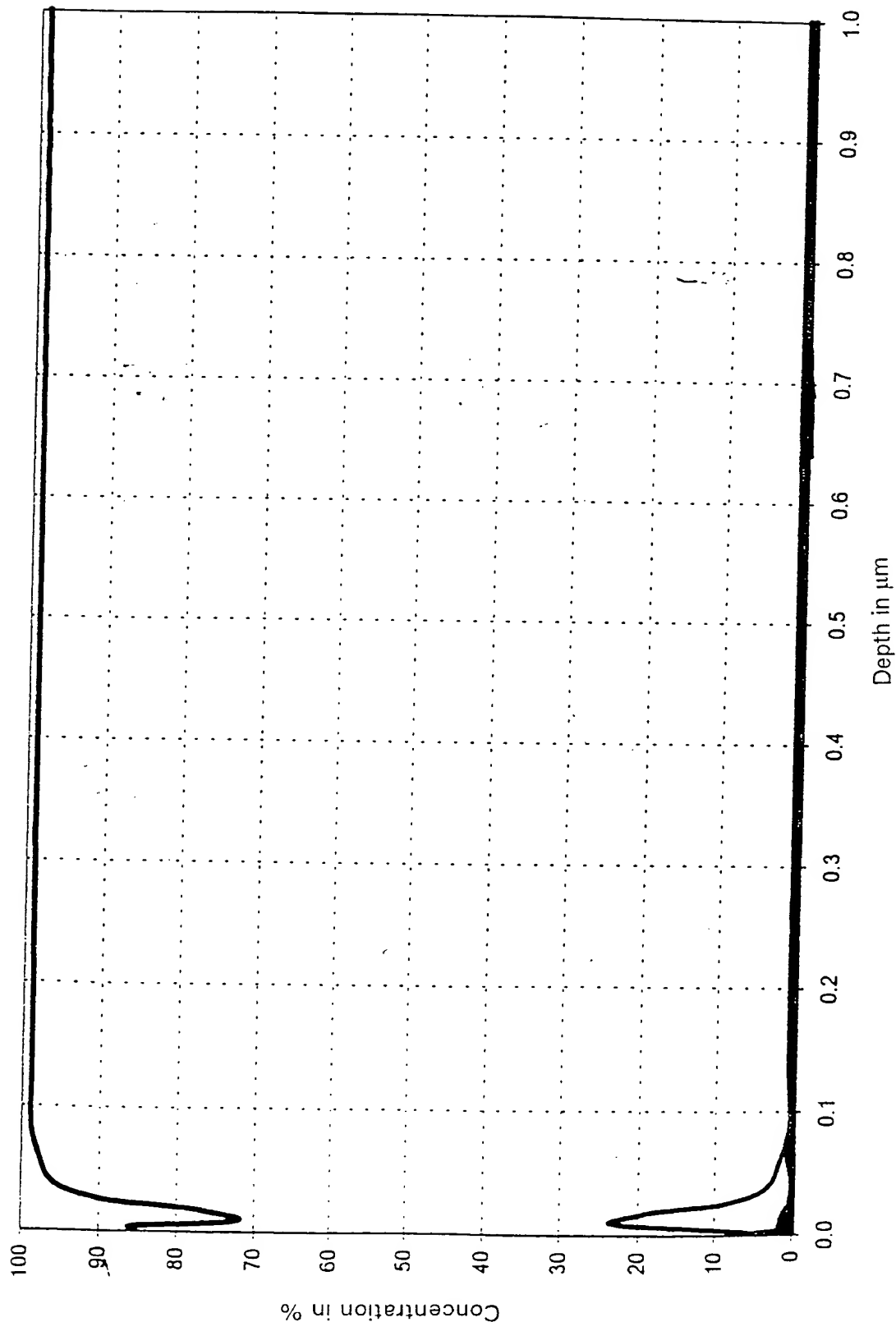


FIG. 31

Sample 8, Measurement Position A

Diagram 1

FIG. 32

Sample 8, Measurement Position A

Diagram 2

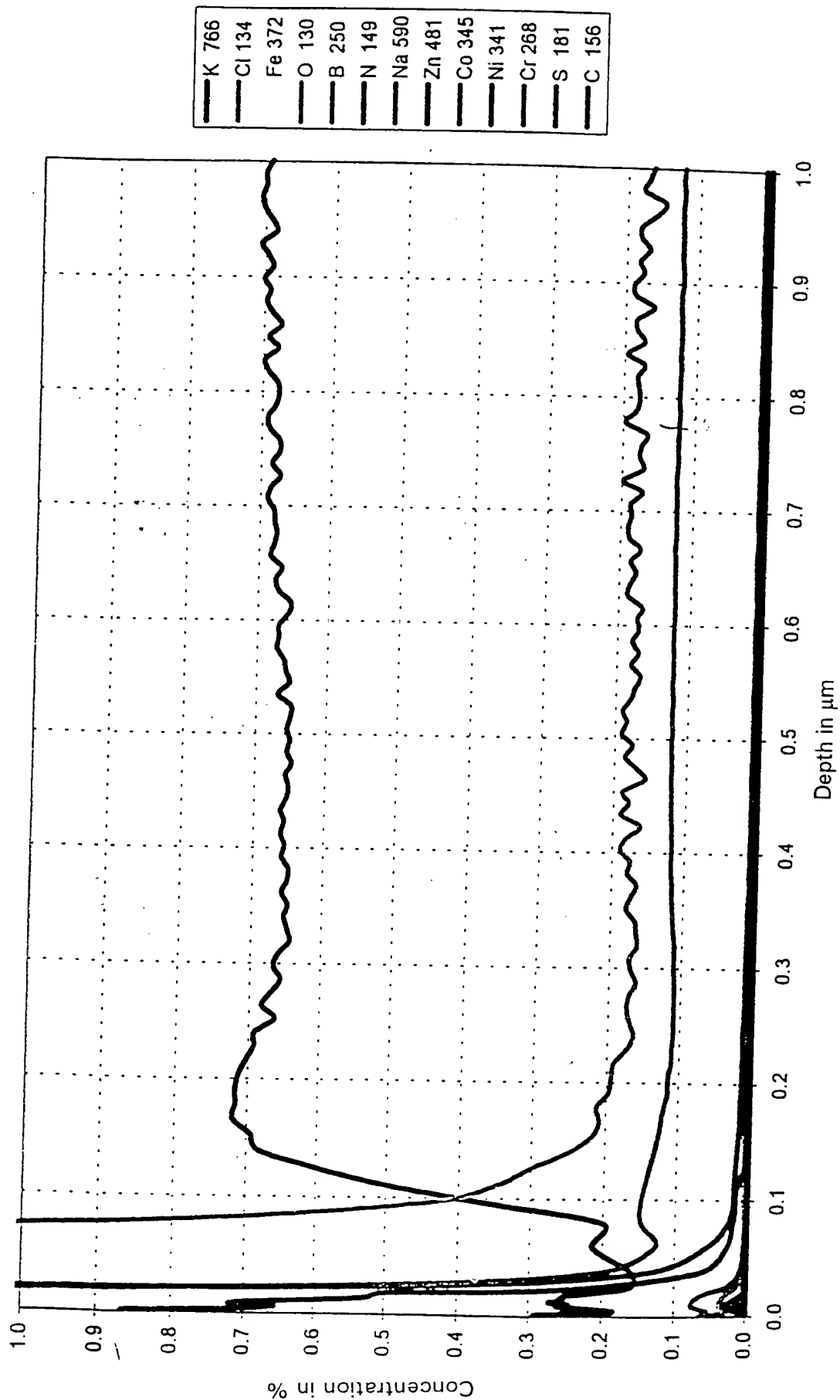
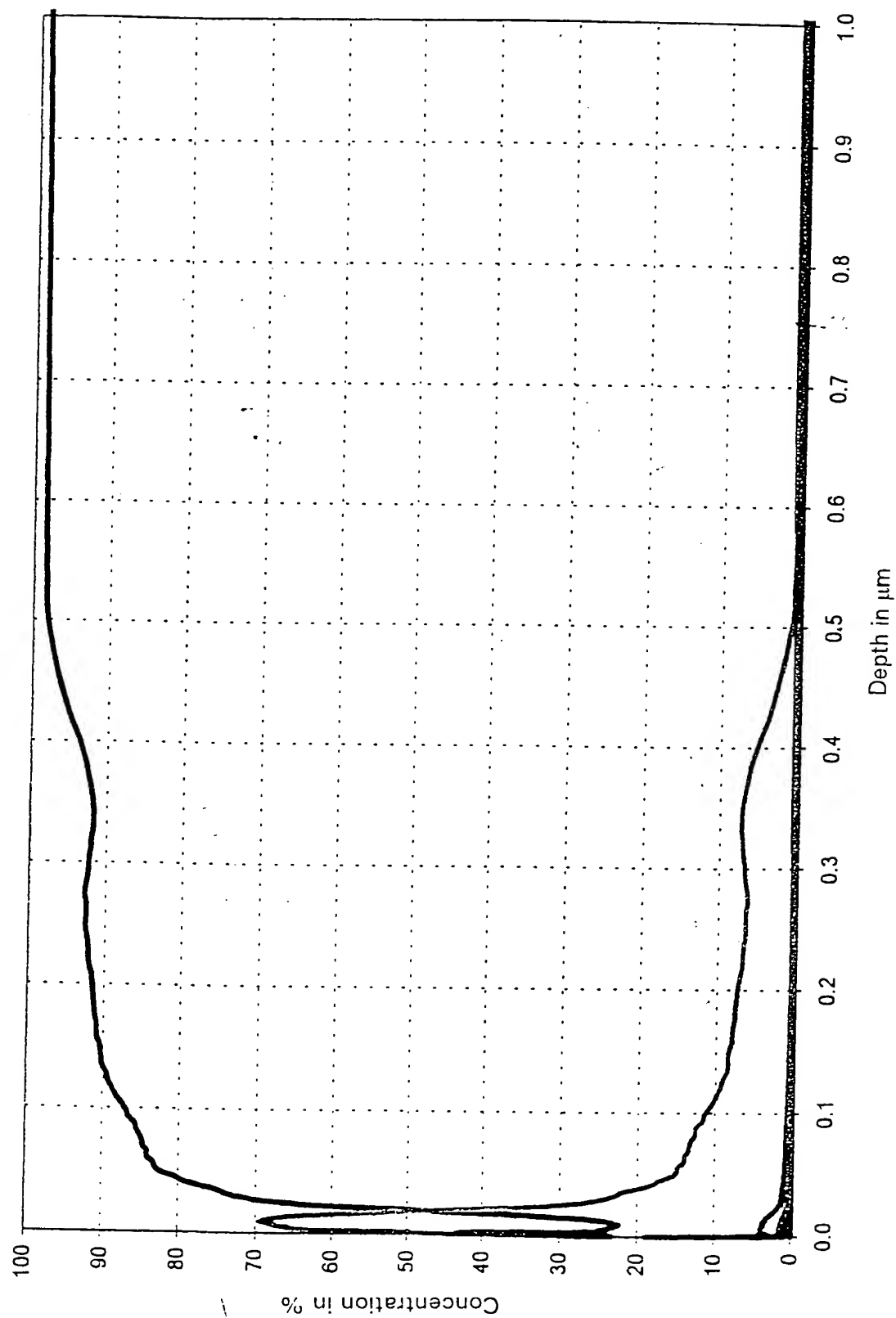


FIG. 33

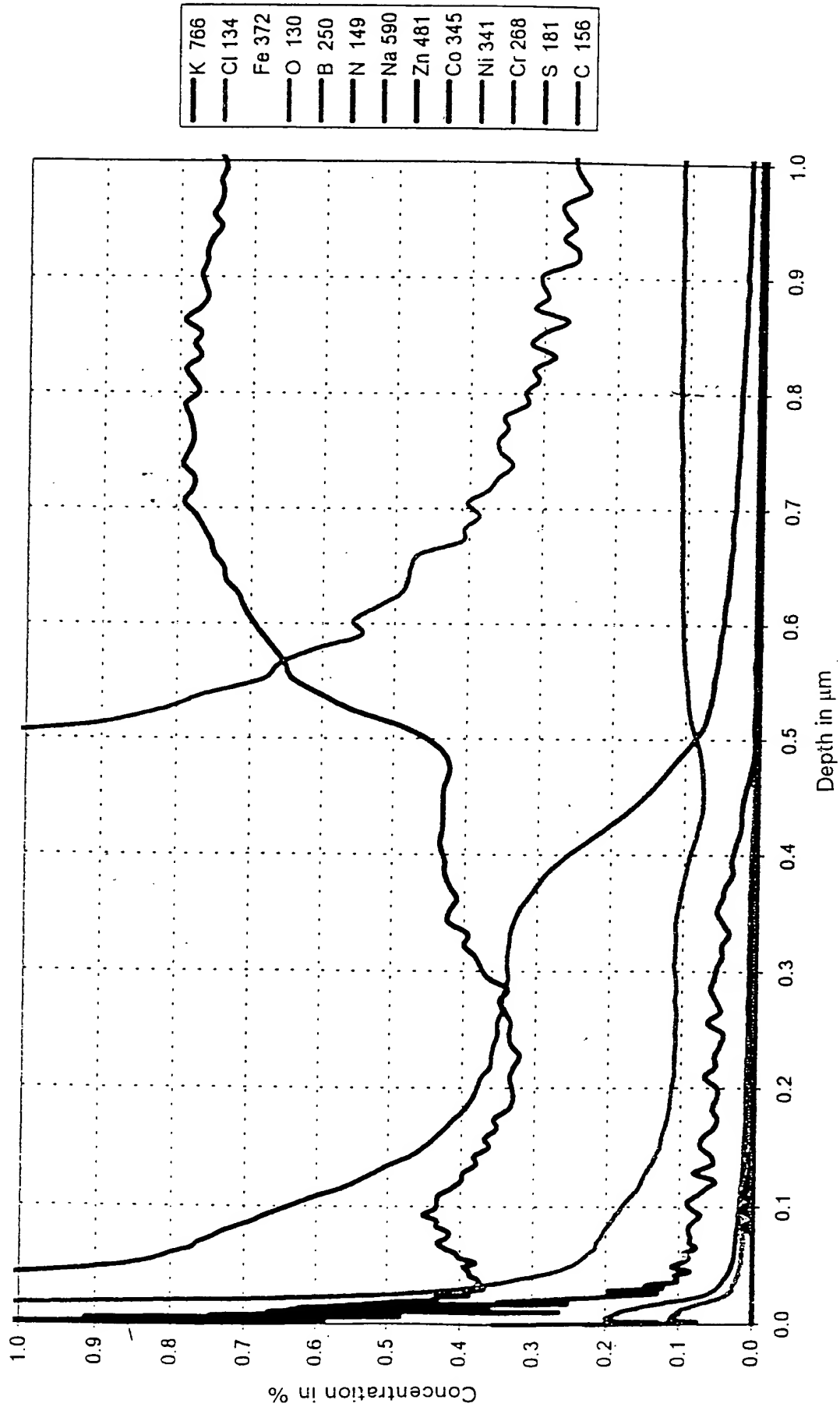
Sample 9, Measurement Position A



☐ K 766
☐ Cl 134
 Fe 372
☐ O 130
☐ B 250
☐ N 149
☐ Na 590
☐ Zn 481
☐ Co 345
☐ Ni 341
☐ Cr 268
☐ S 181
☐ C 156

FIG. 34

Sample 9, Measurement Position A



—	K 766
—	Cl 134
—	Fe 372
—	O 130
—	B 250
—	N 149
—	Na 590
—	Zn 481
—	Co 345
—	Ni 341
—	Cr 268
—	S 181
—	C 156

Sample 9, Measurement Position B

FIG. 35

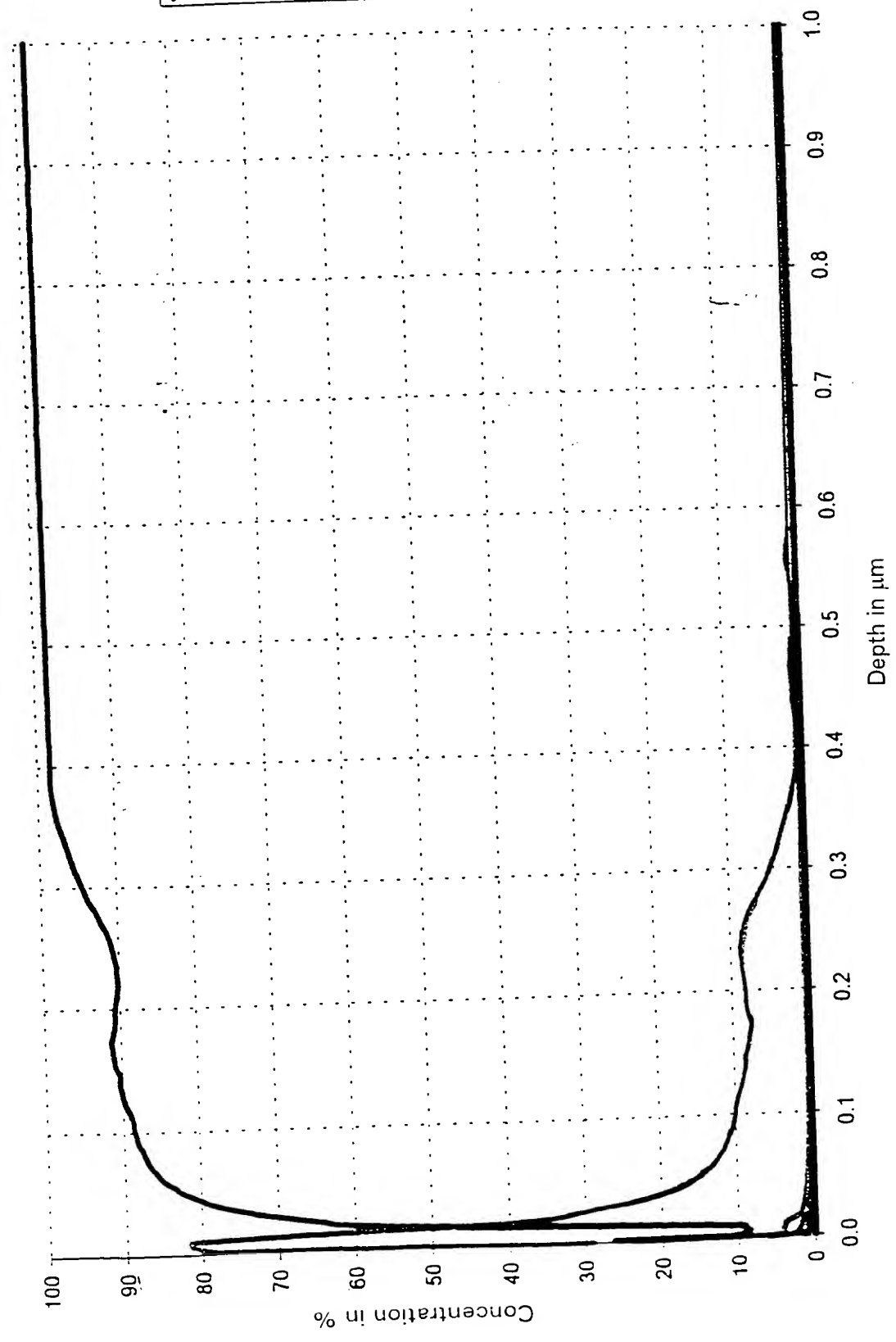


Diagram 1

Sample 9, Measurement Position B

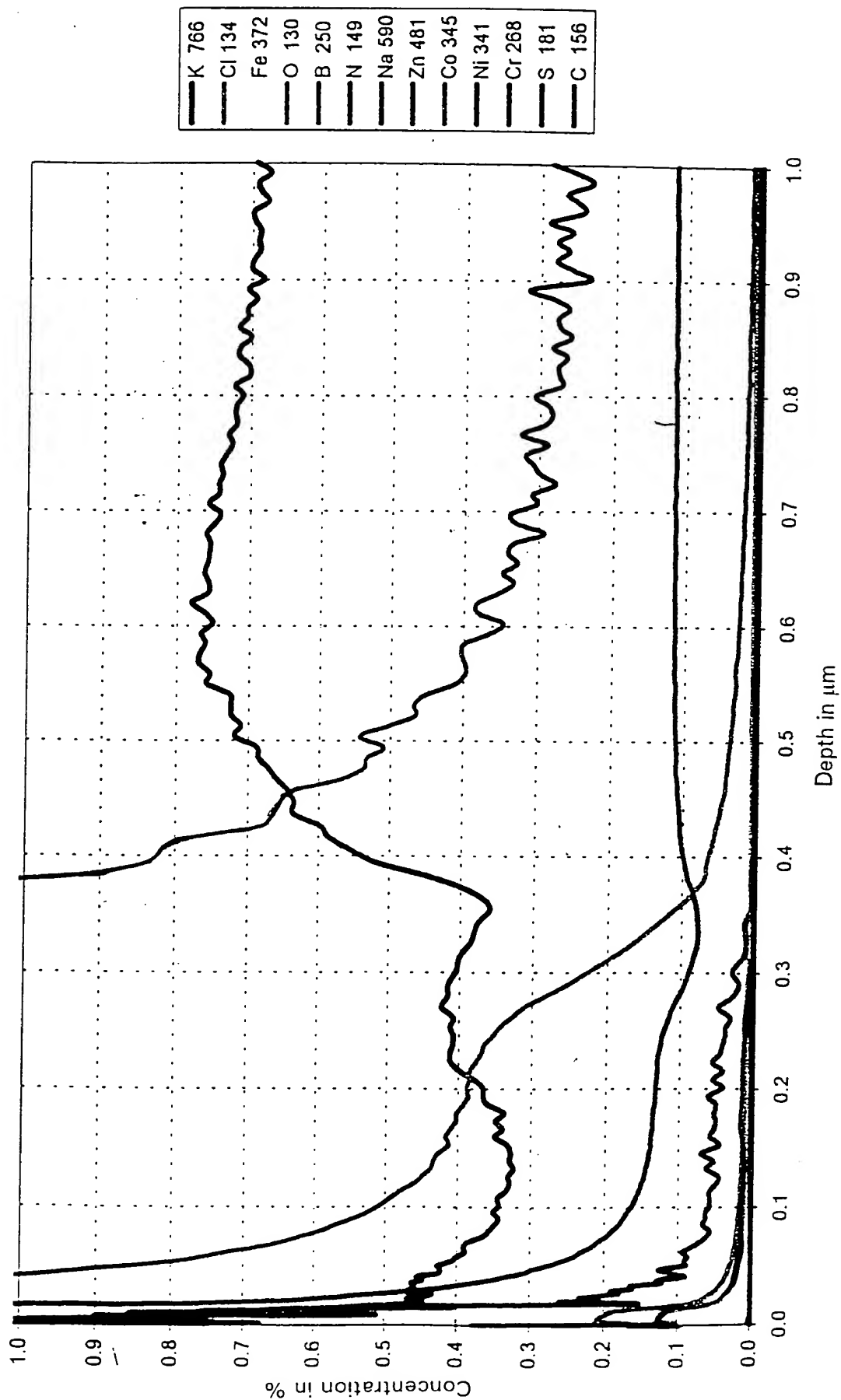


FIG. 37

	Methods					
	Ellipsometry nm	SEM nm	Glow-discharge nm (Cr > 1%)	spectrometer with Cr (%)	chromium index nm (Cr > Zn)	nm (Cr > 30%)
1. Prior Art						
Yellow chromation Cr(III) + Cr(VI)	-	300	440	11	48	25
Blue chromation Cr(III)	98	60	60	8	5	0
2. Invention (Chromitization)						
60 °C Cr(III)	432	300	344	7	23	2
100 °C Cr(III)	595	-	358	10	38	22
60 °C on Zn/Fe Cr(III)	-	-	282	6	16	0
100 °C, two-fold concentration Cr(III)	953	-	-	-	-	-

1,2,3,4,5

6

7

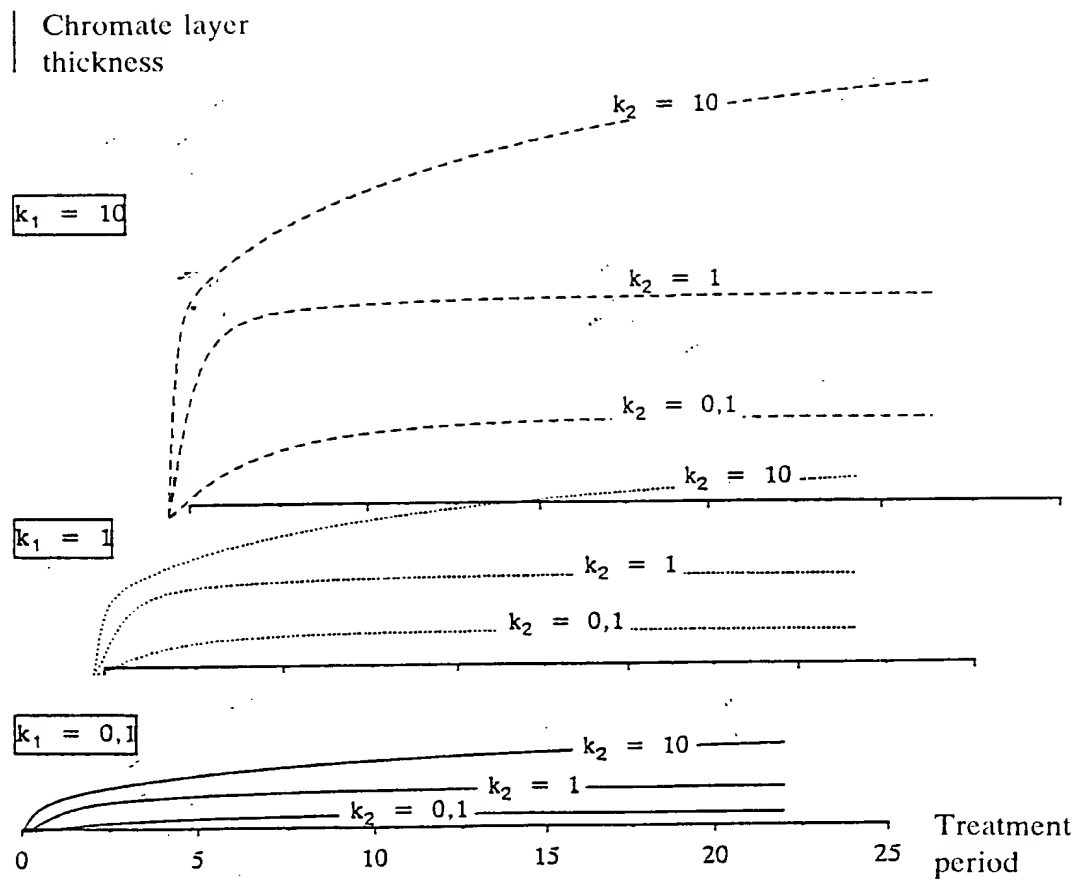
09/171558

9

8

Fig. 38

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Computer simulation of the kinetic model of
chromate coating of zinc for various rate constants